SCOTTISH HOME AND HEALTH DEPARTMENT

SCOTTISH HEALTH SERVICES COUNCIL

Bronchitis

Report by a Sub-Committee of the Standing Medical Advisory Committee

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REMIT

"In view of the high prevalence of bronchitis in Scotland, to consider and report on the epidemiological and ætiological factors which may be responsible, and suggest what additional measures should be undertaken to evaluate and deal with this problem."

PREFACE

by the Standing Medical Advisory Committee

The Standing Medical Advisory Committee were so impressed by the evidence presented in this Report that they wish to emphasise the importance of atmospheric pollution and cigarette smoking as the principal preventable causes of chronic bronchitis. The Committee believe that immediate action ought to be taken to deal with both of these causes.

While stressing the need to discourage by all possible means the smoking of cigarettes the Committee recommend that particular attention should be given to the promotion of clean air in Scotland.

The Committee also wish to draw attention to the need to encourage research into the many clinical and epidemiological problems which have still to be solved.

October, 1962.

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PART I

The Report

Introduction

1. At the meeting of the Standing Medical Advisory Committee (Scotland) on 9th March, 1960, we were appointed as a Sub-Committee with the following terms of reference —

> "In view of the high prevalence of bronchitis in Scotland, to consider and report on the epidemiological and aetiological factors which may be responsible, and suggest what additional measures should be undertaken to evaluate and deal with this problem."

2. We had nine meetings. We decided to invite by letter interested individuals to submit evidence. Written and oral evidence was invited from the persons and organisations listed in Appendix I and their contributions have been summarised in Part IV of this report. We express our thanks to all who assisted us in this way.

3. Part I contains our unanimous views based on our individual and collective experience and on data presented to us. Parts II, III and IV incorporate the evidence with which we were supplied during our deliberations. It does not follow that we share all the views expressed in the Summary of Evidence reproduced in Part IV.

4. At the outset we recognised the difficulty in defining what is meant by the term "chronic bronchitis." We accept the view that this term should be used to describe the clinical condition characterised by the hypersecretion of mucus causing recurrent or persistent productive cough and by an increased tendency to bronchial infection and reduction of ventilatory capacity. It should be added that, once started, the process is likely to be progressive in the absence of, and often in spite of, treatment.

Extent of problem

5. The importance of bronchitis as a cause of death is discussed in Part II of this report. The high official death rates from this disease in Britain have been the subject of much comment in recent years. It seems clear that the excess over the rates in other countries is real and cannot be more than partly explained by differences in diagnostic classification. Among the European countries for which relevant information is available it is only in Britain that mortality from bronchitis exceeds three per cent of deaths from all causes. Compared with 20 other European countries the death rate from bronchitis in Scotland occupies highest place after England and Wales. During 1960, the last year for which the crude mortality rates are available for most of these countries, the figure for bronchitis in Scotland was 43 per 100,000 of the population compared with 58 in England and Wales, 41 in Northern Ireland and 37 in Eire. These figures contrast with rates which ranged between 3.4 in Hungary and 25 in Portugal. In almost all European countries there is an

excess of mortality among men, among whom there were in 1958 between 1.1 and 2.9 deaths for every death among women.

6. In Scotland bronchitis is responsible for about 2,500 deaths each year, compared with about 10,000 deaths from coronary thrombosis, about 2,500 from lung cancer and about 500 from respiratory tuberculosis. It accounts for between three and four per cent of all deaths and between six and seven per cent of deaths which occur among men in the later years of working life. Nearly two-thirds of the deaths from bronchitis are among men. During the forty years before the mid 1950s the trend of bronchitis mortality has been downwards, with females showing a much more rapid reduction than males. Since then these favourable trends have slowed down or have been replaced by an increase in mortality. Only among men aged between 55 and 64 years, however, has this recent upward trend elevated the current mortality rate to the 1921-3 level. With minor exceptions, the death rate in 1960 has been substantially lower in all age ranges in both sexes than it was in 1959. These fluctuations are, of course, influenced by winter epidemics of respiratory infections which vary in severity from year to year.

7. The prevalence of bronchitis among the general population, or among specific sections of it, is not accurately known. In recent years some attention has been given to measuring the frequency and the severity of the disease in random samples of the community. The only survey carried out in Scotland (Higgins and Cochrane, 1958) revealed that nearly 20 per cent of men between the ages of 55 and 64, living in a rural district in Dumfries, had a persistent cough with sputum and that nearly seven per cent presented symptoms of chronic bronchitis. In this, and in most of the other surveys mentioned in this Report, "chronic bronchitis" means a persistent cough and sputum complicated by one or more chest illnesses necessitating absence from work for at least one week during the previous three years.

In surveys involving the examination of random population samples in selected urban and rural communities in England and Wales, between 18 and 32 per cent of men between 55 and 64 years had a persistent cough with sputum while between 6 and 15 per cent of them suffered from chronic bronchitis (Higgins, 1957 and Higgins et al, 1956, 1959, 1961). Findings of the same order have been reported by the College of General Practitioners (1961) whose survey showed that a clinical diagnosis of bronchitis was made in 17 per cent of men and 8 per cent of women between the ages of 40 and 64 years. When a standard diagnosis was applied, based on the occurrence of morning phlegm in winter, attacks of cough and phlegm lasting three weeks in the previous two years and hreathlessness on the level, the prevalence in this latter study was eight per cent among men and three per cent among women. These surveys showed that the prevalence of chronic bronchitis among women of between 55 and 64 years was only about half the male rate. According to the observations of Higgins and his co-workers nearly one in three men in certain dusty occupations have been shown to be affected. There is also evidence that the prevalence of this disease is suhstantially higher among the lower social groups of the population, among those who live in the industrial areas and among those who smoke.

8. Among the working population chronic bronchitis accounts for about ten per cent of all forms of incapacity among men and seven per cent among women. The importance of bronchitis increases with age among men until, at

the age of 55-64 years, one in every six new spells of incapacity is due to this cause. In Scotland during 1958/59 bronchitis accounted for a loss of about three million working days over a period of 12 months.

Aetiology

9. Having reviewed the rapidly accumulating evidence, we are firmly of the view that cigarette smoking is one of the most important causes of bronchitis. The prevalence of persistent cough and phlegm and of chronic bronchitis is consistently and substantially in excess among cigarette smokers. This finding and other evidence strongly suggests that the relationship is one of cause and effect.

10. Having reviewed the evidence incriminating atmospheric pollution, we are in full agreement that this is the other major factor which contributes to the development and progression of this disease. It is probable that atmospheric pollution is an important factor in determining the urban-rural differences in incidence and mortality and also the disparities in the death rates in different countries.

11. The prevalence of bronchitis among men is substantially greater than among women. How far this difference represents differences in habit or in constitution is still a matter for conjecture. Although some workers believe that the male excess merely reflects differences in the smoking habits of the two sexes it is possible that women are less susceptible to the disabling consequences of bronchial irritation from this cause.

12. Social class is another important factor in the occurrence of bronchitis but, here again, there is considerable doubt as to the reason for the excess prevalence among the lower social groups. Since this excess is just as great for wives, whose social class is determined by the occupation of their husbands, it seems likely that these difference are environmental rather than occupational. Nevertheless, it is clear that certain dusty occupations increase the risk of bronchitis.

13. There is considerable doubt about the importance of infection in determining the onset of the bronchitic process. We can find no clear evidence to substantiate the common belief that childhood chest ailments predispose to the development of chronic bronchitis in adult life. On the other hand there is no doubt that infection plays a dominating role in determining the occurrence of the acute exacerbations and probably also in the rate of progression of the disease. Although bacterial infection has been widely studied and its importance accepted an assessment of the influence of viral infection requires much more research.

14. We found that no adequate studies have yet been made on the role of heredity in determining the incidence of chronic bronchitis, nor have British workers produced any evidence that allergy is a significant factor in the causation of chronic bronchitis in this country.

Services for ascertainment and treatment

15. No special services have been established for the ascertainment or special management of bronchitic persons. The individual is in the best position to recognise the early symptoms of the disease. For this reason the public should be informed about the importance of the apparently simple deviations

from normal health, such as morning cough, which are precursors of chronic bronchitis and they should be warned that these often develop into a serious and disabling disease. At present most patients consult their family doctor when the disease is already well advanced. The responsibility for the medical care of bronchitic patients rests with the family doctor whose important functions are to exclude the presence of other serious chest diseases by arranging for further investigation including X-ray examination of the chest, to use antibiotic drugs to prevent or to control quickly any intercurrent bronchitic infection and to prevail on the patient to stop smoking.

16. Where specialist consultations are necessary for the diagnosis of the condition or for assessment of the degree of disability the practice has grown up for patients to be referred to physicians in the chest clinic service. Among other advantages the patient may benefit from the social services which have been developed in these clinics for the care of the tuberculous patient. Nevertheless we believe that the isolation of this work from that of the specialised medical services provided by the general hospitals will limit or hinder its essential technical development. The chest service or the facilities provided for the diagnosis and care of patients suffering from diseases of the chest would undoubtedly gain much from a close association with the general hospital and all its specialised services.

17. It is important that all teaching hospitals should accept responsibility for the diagnosis, assessment and management of this important disease. Until the preventive measures suggested below are effectively put into operation, chronic bronchitis will require a special contribution from the resources of medical and technical skill available in the teaching centres. These centres should become the focal point of research activity in the area and undertake the teaching of students and post-graduates in the care of this disease.

18. During the last few years simple tests of pulmonary ventilation have been available in most hospitals and clinics. In a few centres more complicated measurements of function, including gas exchange, have been introduced for the assessment of respiratory disability. The development of more refined procedures demands equipment, technical assistance and knowledge beyond the resources of all but the most specialised units engaged in the investigation of difficult cases and in research.

19. We have considered the value of chemotherapy and concluded that much is to be gained from the proper use of drugs during the acute infective episodes to alleviate symptoms, reduce incapacity and, it is believed, limit the progression of the condition. We take the view that the cost of this treatment should not be regarded as a proper reason for withholding it. Although there seems to be little danger of drug resistance some of the drugs employed can have important side-effects and must, therefore, be used with discretion.

20. We reviewed the suggestion that breathing exercises can produce an objective improvement in ventilatory performance. Although there is some support for the view that these exercises result in a definite, if temporary, subjective improvement, there is little evidence to suggest that they produce an important increase in ventilation or gas exchange. Until such evidence is produced we would regard expenditure for the expansion of the provision of this treatment as unjustified.

Prevention

21. We believe that the greatest contribution to the control of this disease is to be made by the elimination of atmospheric pollution and by effective measures against cigarette smoking. The achievement of these objectives would produce far-reaching improvements in health. We believe that a major reduction in cigarette smoking would greatly reduce the incidence of chronic bronchitis.

22. We have noted with interest the attempts which are being made by local authorities to promote clean air in Scotland. The evidence incriminating atmospheric pollution is compelling and there can be no doubt that the freeing of the air of the products of combustion, both visible and invisible, is likely to play a significant part in reducing the prevalence of this disease. This programme should be pursued with the greatest energy.

23. Another factor which we have considered is domestic over-crowding. Surprisingly enough there is no clear evidence that this feature of home circumstances is important in the occurrence and progression of chronic bronchitis. The whole problem of domestic environment in relation to chest diseases needs further investigation.

24. For those who have developed symptoms much can be done to reduce the frequency of exacerbations and curtail loss of working time by the judicious use of antibiotics as preventive agents. There is evidence to support the use of certain drug regimes but it is not certain which of these is best from both the therapeutic and economic points of view. While the prescription of drugs, some of which are expensive, must remain within the discretion of the individual physician we believe that the medical and economic advantages of preventive chemotherapy outweigh the cost to the national drug bill.

25. While it is difficult to assess the importance of dust control in industry as a specific measure of prevention, we have no doubt that the effect of dust on an already unhealthy lung, is likely to aggravate the disease. We would, therefore, emphasise the need for effective dust suppression in industry.

26. The prevention of bronchitis might be furthered by more detailed knowledge about the incidence of the disease in different circumstances and in different geographical areas. To supplement the information obtained from the mortality statistics it has been suggested that a system of notification, to the Medical Officer of Health, might be introduced experimentally. This might add to epidemiological knowledge and bring into play services such as those which assist with housing, rehabilitation and other problems which affect the patient who is becoming progressively disabled. While we do not suggest that notification should be introduced generally, we believe that, in spite of the many inherent difficulties, it should be tried out in one or two areas on an experimental basis.

27. The prevalence surveys which have been carried out in different areas have added greatly to knowledge of the epidemiology of chronic bronchitis. Although these surveys are costly and time-consuming they are an essential method of assessing the distribution and frequency of the disease in different localities, social classes, occupations and environments. They have also provided valuable information on smoking habits and their relation to the disease. We have noted that only one such study has been undertaken in Scotland and believe that an extension of this work including forward-looking

studies would be a valuable means of adding to the present knowledge of prevalence and ætiology.

Propaganda

28. From our present understanding of the causes of chronic bronchitis it is clear that the public has a vital part to play in its control. We have already stressed the dangers of cigarette smoking and this should be the subject for determined propaganda and health education. The accumulating facts incriminating tobacco smoke and atmospheric pollution are well-known to the medical profession. It is essential that the facts are made widely known to the public. This is primarily the duty of the central and local governments but both specialists and general practitioners should help in this task.

Rehabilitation and resettlement

29. We have considered the question of rehabilitation and resettlement for the bronchitic patient. The disease, with its progressively disabling effects, its liability to increasingly frequent acute exacerbations and its increased prevalence in the unskilled occupations, poses many questions of a medical, social and economic nature. The extent of the problem is masked by the fact that bronchitics in sedentary employment are able to carry on long after their ventilatory capacity would be inadequate for active physical work. Further, since disability does not manifest itself until later life, the manual worker is frequently unable to benefit from any attempt to place him in a more suitable occupation. In these circumstances simple matters of housing and recreation become problems of great moment. We were only able to study this matter in the most superficial manner because of the lack of suitable statistics. Pending further study we agree that existing services on the lines currently provided by chest clinics should be utilised for chronic bronchitics. We recognise that among patients with chronic bronchitis there is much distress and economic loss which should be alleviated and we should welcome any experimental scheme for the exploration and solution of the problems involved.

Research

30. Since there are still so many gaps in our knowledge of this disease we would urge that encouragement and assistance should be given to those who are competent and willing to pursue promising lines of inquiry.

Among the many pressing clinical problems are the nature of the impairment of lung function, the relative importance of the different factors which may lead to obstruction of the air passages and the degree of reversibility of functional disability. Investigations in this field involve the use of many disciplines, including physiology, bacteriology, virology, pathology and therapeutics, each of which has a significant contribution to make.

Regarding epidemiological research, we agree that important information is to be gained from prevalence studies conducted on the lines of those mentioned in Part II of the report. Nevertheless, we conclude that more is likely to accrue from forward-looking studies of the natural history of the disease as it develops in the community. We believe that the case against cigarette smoking and atmospheric pollution has been made; but there is room for further studies of the interaction of these two ætiological factors and of the possible aggravating effects of infection and of environmental influences such as climate. Priority could properly be given to the investigation of methods of helping people to stop smoking cigarettes.

Clearly the clinical and epidemiological problems are interdependent. Further studies are necessary to determine the causes as well as the permanent effects of the acute exacerbations and the best methods of preventing and controlling them by the expeditious use of drugs or by other measures. Investigations of this kind require the support of the laboratory services for bacteriology and virology if the role of infection is to be properly assessed.

We have referred earlier to the lack of evidence on the results of breathing exercises in the treatment of bronchitis and to the desirability of studying rehabilitation and resettlement; and we would welcome any scientific work on these problems.

Finally, we would again like to stress the importance which we attach to the promotion of research projects in Scotland and to the provision of facilities for research in teaching and other centres concerned with the care of the bronchitic patient.

* * *

31. We should like to express our warm appreciation of the services given by the Secretaries, Dr. I. M. Macgregor and Miss M. J. Yeats, for their assistance in our work and for the valuable part they played in the preparation of this Report.

PART II

Bronchitis Mortality and Morbidity

32. The Sub-Committee were provided with such statistical information as was available to enable them to measure the size of the problem. These data have been obtained from the Annual Reports of the Registrar General for Scotland and from the Scottish Health Statistics published annually by the Department of Health for Scotland. Information on social class and occupational mortality has been taken from the Decennial Supplement of Occupational Mortality published by the Registrar General for England and Wales since no comparable statistics have yet been produced in Scotland. Where international comparisons are made, these are based on data abstracted from the reports on Epidemiological and Vital Statistics published by the World Health Organisation. Some of the statistics, to which reference is made, have already been the subject of comment (Health Bulletin Vol. xviii, No. 2, April 1960). For data on prevalence, reference has been made to the published reports of a number of workers.

The principal data have been incorporated in Appendices while the more important items are summarised and illustrated in the text which follows. While the Sub-Committee discussed, on a number of occasions, how the currently available statistics might be used to add to knowledge regarding the ætiological factors concerned in the onset and progression of bronchitis, they did not interpret their remit as meaning that they should personally conduct inquiries into this or allied subjects.

Relative Importance of Bronchitis as a Cause of Death and Incapacity in Scotland

Bronchitis mortality (Appendix II)

33. In 1960 bronchitis accounted for 1,589 male deaths and 625 female deaths. The former amounted to five and the latter to two per cent of mortality

from all causes. Between the ages of 45 and 64 years this condition was responsible for six per cent of all deaths among men. Table 1, showing the relative frequency of death from bronchitis compared with mortality from other major causes, illustrates the important contribution made by this disease, especially among the male population, during the later years of working life. During 1960, it was responsible for rather fewer deaths than lung cancer but for more than four times the number of deaths from tuberculosis.

TABLE 1

Deaths from selected diseases in Scotland, 1960

		All ages			45-64 years		
		Deaths	Rate /100,000	Per cent *	Deaths	Rate /100,000	Per cent *
Heart disease	M	10,983	438	35	3,561	603	38
	F	10,390	385	35	1,639	246	28
Malignant Neoplasms	M	5,815	232	18	2,438	413	26
	F	5,218	193	17	1,939	291	33
Vascular lesions of C.N.S.	M	4,206	168	13	830	140	9
	F	5,644	209	19	836	125	14
Respiratory Neoplasms	M	2,160	86	7	1,203	204	13
	F	389	14	1	175	26	3
Bronchitis	M	1,589	63	5	579	98	6
	F	625	23	2	110	16	2
Tuberculosis	M	345	14	1	168	28	2
	F	155	6	1	43	6	1

* Per cent. of deaths from all causes

Trends of bronchitis mortality in Scotland (Appendix III)

34. Appendix III shows the bronchitis death rates by age and sex for the triennia around the census years (except 1941-3) from 1921-3 and for individual years from 1954. This shows the progressive reduction in mortality rates between 1921 and 1954 from 86 to 36 per 100,000. During this period the male rates fell by 41 per cent from 90 to 53 per 100,000 and the female rates by 65 per cent from 83 to 29 per 100,000. Since 1954 the rates for males have tended to rise, reaching a figure of 63 in 1960 while the rates for females during the same period have been fairly consistent.

Trends of mortality by age and sex in Scotland (Appendix III)

35. The data presented in Appendix III shows that, with the exception of men between 55 and 64 years, the current rates of bronchitis mortality are substantially lower than they were forty years ago. The greatest improvement has been experienced by children under 5 years of age among whom the infective element predominates. At all ages the reduction has been greater among women. During the last few years there has been a tendency for the rates to increase among men of 55 years of age and over. The recent changes are illustrated in Table 2 and in Figures 1 (for males) and 2 (for females) while the age and sex specific rates for 1960 are shown in Figure 3.

TABLE 2

Bronchitis death rates by age over 35 years and by sex from 1954 as a percentage of the 1951-53 rates

Age	1951–3 rates		Death rates as a percentage of the 1951-3 rates														1960 rates	
			1954		1955		1956		1957		1958		1959		1960			
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
35—	8	4	88	75	113	100	100	125	75	50	88	100	125	75	50	75	4	3
45—	47	12	92	83	115	67	92	75	89	75	106	92	117	92	79	75	37	9
55—	152	35	99	97	111	77	108	92	117	86	129	111	133	109	117	71	178	25
65—	260	101	95	80	114	99	125	88	122	87	149	90	158	115	153	85	397	86
75—	489	330	83	72	93	84	98	71	88	62	93	65	115	80	108	63	528	207
85+	951	825	89	71	76	70	95	71	89	59	80	62	80	72	74	54	707	444
All Ages	53	29	93	83	108	90	110	83	108	76	123	86	134	100	119	79	63	23

Sex ratios of the death rates from bronchitis (Appendix III)

36. The substantially different experience of the two sexes in respect of bronchitis mortality has been an outstanding feature of this disease. The sex ratios for persons of 35 years of age and over, and the substantial changes which have occurred in them since 1931, are shown in Table 3. With the exception of the very old in the earlier years, the heavier death rates have been experienced by men of every age in each period. The relative extent of this male excess is greater now in each age range over 45 years than at any time in the past. Further, the male excess is now greatest among persons aged 55-64 years and not, as previously, earlier in adult life.

TABLE 3

Sex ratios (M:F) of the death rates at ages 1921-1960

Age	M:F ratios			
	1921–3	1931–3	1951–3	1960
35—	1.1	1.9	2.0	1.3
45—	1.6	1.8	3.9	4.1
55—	1.5	1.4	4.3	7.1
65—	1.2	1.4	2.6	4.6
75—	1.2	1.2	1.5	2.6
85+	0.9	0.8	1.2	1.6
All ages	1.1	1.1	1.8	2.7

Bronchitis morbidity

37. Routine information on the incidence of bronchitis is available only from the returns relating to incapacity provided by the Ministry of Pensions and National Insurance and published in Scottish Health Statistics by the Department of Health for Scotland (HMSO 1960). Table 4 shows the number of new incapacities ascribed to bronchitis in the insured population. These are based on the analysis of a five per cent sample.

TABLE 4

Average annual number of new incapacities from bronchitis by age and sex in Scotland, 1956/7-1958/9

Age	Number of incapacities	
	Males	Females
—25	5,870	6,870
25—	6,700	3,290
35—	8,040	2,850
45—	13,520	3,250
55—	15,630	1,780
65+	2,750	—
Total	52,510	18,040

Although these incapacities do not necessarily relate to individuals the majority are likely to relate to separate persons. When the 1957 data are expressed as rates based on the estimated population at risk (Health Bulletin vol. xviii April 1960) the results show the expected rapid rise of incapacity from this cause for men over the age of 25 years (Table 5). Women, on the other hand experienced their highest rates in the younger and older age ranges with lower intervening levels. Under the age of 35 years the female rate is actually higher than the male. As would also be expected, bronchitis contributes an increasing proportion of the spells of incapacity with advancing age in both sexes, the progression being steeper among men. At all ages in 1957, bronchitis accounted for nearly ten per cent of male and for seven per cent of female incapacity.

TABLE 5

New incapacities from bronchitis by age and sex in Scotland during the year ended April, 1957

Age	Males		Females	
	Rate/100,000	Per cent. of all incapacities	Rate/100,000	Per cent. of all incapacities
25—	100	5.3	118	6.4
35—	133	7.7	102	8.8
45—	228	12.3	115	9.3
55—	357	16.7	119	10.8
All ages	—	9.6	—	7.0

That bronchitis is an important cause of chronic incapacity is shown in Table 6 which includes the rate, for each sex in broad age groups, for cases of bronchitis which persisted throughout the statistical year and the number expressed as a proportion of chronic incapacities from all causes at corresponding ages. Again chronic incapacity increases in incidence with age in both sexes and is appreciably heavier in men. Chronic incapacity from this cause accounts for 10 per cent of all chronic incapacities among men but only for two per cent among women.

TABLE 6

Bronchitis as a cause of chronic incapacity (cases lasting over the whole year ended April, 1957)

Age	Rate/100,000		Per cent. of total chronic incapacities	
	M	F	M	F
—45	0.5	0.4	1.7	0.9
45—	8.2	3.0	7.8	2.0
55—	44.3	10.1	14.4	4.0
All ages	8.4	1.7	9.9	2.1

The duration of incapacity from bronchitis is illustrated by the data in Table 7 which includes only these cases in which the incapacity terminated during the year ended April, 1959. More than half the cases among both men and women terminated in less than 18 days and only three per cent of male and two per cent of female incapacities lasted over six months.

TABLE 7

Frequency distribution of duration in cases terminating during the year 1958/9

Duration of illness* (Working days)	Terminated cases†			
	Males	Per cent.	Females	Per cent.
— 3 days	1,460	2.6	220	1.3
4— 6	7,120	12.6	2,300	13.2
7— 11	10,640	18.8	3,340	19.2
12— 18	14,440	25.6	4,480	25.8
19— 24	5,940	10.5	2,020	11.6
25— 30	3,960	7.0	1,100	6.4
31— 36	2,320	4.1	820	4.7
37— 42	1,940	3.4	340	2.0
43— 48	1,140	2.0	540	3.1
49— 78	3,240	5.7	1,200	6.9
79—156	2,600	4.6	700	4.0
157—234	640	1.1	160	0.9
235—312 days	180	0.3	40	0.2
1— 2 years	340	0.6	120	0.7
3	160	0.3	0	0
4	100	0.2	0	0
5	120	0.2	0	0
6	60	0.1	0	0
7	40	0.1	0	0
over 7 years	100	0.2	0	0
	56,540	100	17,380	100

* The year is regarded here as comprising 312 working days (six days each week)

† A terminated case means a person who ceases to draw sickness benefit for any reason — because he or she has resumed work, died, left the country or is no longer entitled to benefit because of age.

International Comparisons (Appendices IV and V)

38. Appendix IV shows the annual death rates for selected countries in the European region for the years 1957 to 1960, M:F ratios and the proportion of bronchitis deaths expressed as a number of deaths from all causes during 1958. The substantial excess of deaths attributed to this cause in the British Isles is apparent, the rate for England and Wales being considerably higher than that recorded elsewhere, even in Scotland which occupies second highest place in the mortality table. As would be expected, bronchitis, which accounted for 3.7 per cent of deaths from all causes in Scotland in 1958, accounts for a decreasing proportion of the total mortality as the recorded rate from this cause falls. It is of interest to note that the M:F ratio tends to fall with the decreasing death rate from bronchitis although, with the exception of Sweden, the male rate is consistently in excess. It seems doubtful whether differences in diagnostic habit or coding of the causes of death could account for all of the considerable excess of mortality attributed to bronchitis in Britain.

The age and sex specific death rates from bronchitis are shown in Appendix V for Scotland and a number of other countries. Some of these rates are illustrated in Figure 4 for men of 35 years of age and over. This shows the progressively increasing mortality rate with advancing age, although the differences in the levels of these rates are substantial. A comparison between the death rate in Scotland and the mortality in some other countries is shown in Table 8 for males.

TABLE 8

Bronchitis death rate among males in certain countries expressed as a percentage of the rate in Scotland in 1958

	All ages	55-60 years
England and Wales	144	98
Norway	7	3
Denmark	9	3
Belgium	38	23
France	9	3
U.S.A. (White)	5	3

In 1958 the Scottish death rate was about 20 times greater for men of all ages and about 30 times higher for men aged 55-60 years compared with the United States. The interpretation of these data must, however, take account of the differences in diagnostic fashion which undoubtedly exist. The differences between British and American practice have been commented upon by Meneely et al (1960) who have suggested that some of the discrepancies in the rates may be explained to some extent by differences in terminology and in coding practice in the national vital statistics offices.

Urban-Rural differences in mortality (Appendix VI)

39. The substantial difference between the rates from bronchitis experienced by persons resident, at the time of death, in urban, semi-urban or rural areas is illustrated in Appendix VI for the years 1958 to 1960. The significant downward gradient from the former to the latter was also evident at all ages over 34 years in both sexes for the period 1950-3 when the census populations were

available for the calculation of the age and sex specific rates. These findings are reproduced in Table 9. This shows that the rates are greater at all ages for both sexes in the cities than in the rural areas and that this difference in the rates is less pronounced among older people. The urban-rural differences are greater for men than for women.

TABLE 9

Bronchitis death rates per 100,000 by age and sex in administrative aggregates, 1950-3

Age Groups	Four Cities		Other large Burghs		Small Burghs		Landward Areas	
	M	F	M	F	M	F	M	F
35	13	5	9	4	3	4	4	3
45	75	18	53	14	36	7	24	8
55	236	54	179	37	130	27	73	26
65	386	145	278	125	169	59	158	74
75	774	508	600	455	405	317	432	334

Local differences in mortality (Appendix VII)

40. The number of deaths and the death rates in local health authority areas in recent years are reproduced in Appendix VII. The highest mortality was in the towns, among which Glasgow provided by far the highest annual figure during the period 1958-60. Although there are some curious anomalies, for example the high mortality rate of 49 per 100,000 in the County of Bute, the substantial excess in the Clydeside Conurbation is evident.

Regional differences in morbidity

41. The number of days of sickness attributed to bronchitis in the five Scottish Regions and the proportion of days lost to the total from all causes is shown in Table 10. In each sex bronchitis accounts for its heaviest proportion in the Western Region and only to a slightly less extent in the North-East, East and South-East. The North shows the lowest proportion of sickness days ascribed to this cause.

TABLE 10

Days of sickness ascribed to bronchitis and its proportion to total sickness in regions, 1958-59

Region	Days of sickness		% of all causes	
	Male	Female	Male	Female
N	28,940	2,480	4.8	1.1
NE	174,440	47,300	9.1	5.8
E	129,560	44,660	8.9	4.4
SE	467,120	72,860	10.9	4.5
W	1,808,920	523,700	12.0	6.5
Scotland	2,608,980	691,000	11.2	5.9

Seasonal variations

42. Table 11 shows the number of deaths from bronchitis in the two sexes for each month during 1960. This shows that about 37 per cent of the deaths

occurred in the first quarter of the year. In keeping with previous experience the largest number of deaths occurred in the winter period and the smallest in June and July. When examined by age groups the seasonal variations are broadly similar.

TABLE 11

Bronchitis mortality distribution in Scotland, 1960

	Males		Females	
	Deaths	Percentage of annual deaths	Deaths	Percentage of annual deaths
January	201	13	88	14
February	231	15	79	13
March	146	9	64	10
April	130	8	61	10
May	114	7	40	6
June	70	4	27	4
July	66	4	29	5
August	93	6	32	5
September	84	5	43	7
October	92	6	31	5
November	129	8	51	8
December	233	15	80	13
TOTAL	1,589	100	625	100

MORTALITY BY SOCIAL CLASS AND OCCUPATION

43. Since no data have been produced relating to differences in mortality from bronchitis by occupational and social class in Scotland it has been necessary to turn to the Registrar General's Decennial Supplement on Occupational Mortality for England and Wales (1958). Table 12 incorporates the mortality ratios in the five social classes in 1949-53 and compares those with the corresponding analyses at previous periods.

TABLE 12

Standardised Mortality Ratios (S.M.R.) for males by social class (ages 20-65 years). England and Wales

Social Class	1921–3	1930–2	1949–53
I	26	31	34
II	55	57	53
III	94	91	98
IV	121	124	101
V	177	156	171

These figures demonstrate the close association of bronchitis mortality with social class and the comparative lack of change in the nature or intensity of this association over a long period. These data relate only to males between 20 and 65 years of age but the progressive increase in mortality from social class I to V, illustrated in Table 13, is also a feature among older males (P.M.R.) and

married women. The inclusion of married women in this table is of particular interest since social class, based on occupation, differs in many respects besides occupational environment (economic status, geography, housing conditions, etc).

TABLE 13

Standardised Mortality Ratios (S.M.R.) and Proportionate Mortality Ratios (P.M.R.) for bronchitis by social class among males and married women (England and Wales 1949-53)

Social Class	S.M.R. (20-65 yrs.)		P.M.R. (65 yrs. and over)	
	Males	Married Women	Males	Married Women
I	34	35	51	47
II	53	49	73	74
III	98	101	103	103
IV	101	123	106	110
V	171	154	130	130

The fact that married women, who are allocated to the appropriate social class on the basis of their husband's occupation, show just as intense an association with such social class differences as their husbands strongly suggests that the factors determining the excess of mortality from bronchitis are more likely to be environmental than occupational. Except in the case of the armed forces, this close association between bronchitis mortality of men and married women persists even when a more detailed study of classes III, IV and V is made (Table 14).

TABLE 14

Mortality and social class (England and Wales, 1949-53)

Social Class	S.M.R. (20-65 yrs.)	
	Men	Married Women
III. Mineworkers	156	167
Transport workers	99	94
Clerical	90	66
Armed Forces (O.R.)	234	128
Others	95	102
IV. Agricultural workers	56	91
Others	114	132
V. Building and dock labourers	118	126
Others	189	164

At the 1951 Census an alternative socio-economic classification was made, and Table 15 has been abstracted to show the bronchitis ratios for these groups and for the associated group of married women. These data, however, do not add much to the information available from the usual social class grouping. In general the mortality variations for males are matched by almost corresponding differences for married women with husbands in these groups. For individual occupations, however, there are some exceptional differences from the average.

TABLE 15

Bronchitis mortality ratios by socio-economic class (England and Wales, 1949-53)

	S.M.R. (20-65)		P.M.R. (65 +)	
	Men	Married Women	Men	Married Women
Farmers	31	52	59	78
Agricultural workers	53	82	79	85
Higher administrative, etc.	34	35	51	47
Other administrative, etc.	48	43	71	72
Shopkeepers	76	59	84	76
Clerical workers	88	65	86	86
Shop assistants	65	70	91	85
Personal service	117	96	107	107
Foremen	70	93	99	103
Skilled workers	108	112	108	108
Semi-skilled workers	114	138	122	123
Unskilled workers	172	155	130	130
Armed Forces (O.R.)	234	128	81	91
Unoccupied	76	63	76	64

Those occupations with the highest rates for bronchitis, likely to indicate exceptional risk, are shown in Table 16. The two worst groups, army and navy other ranks (retired), are likely to be non-occupational, the explanation for their gross excess death rate more probably being that healthy "other ranks" go into other occupations, and are recorded under these heads, when they retire at a fairly young age.

TABLE 16

Occupations with the highest bronchitis rates (20-65) (England and Wales, 1949-53)

Group No.		S.M.R.
96	Army—other ranks—retired	537
98	Royal Navy—other ranks—retired	440†
185	Makers of glass and glassware—blowers	350†
314	Drivers of horse-drawn vehicles	311
228	Filers	275†
371	Watchmen	270
237	Openers, blenders, rag grinders (cotton)	267*
417	Labourers and other unskilled workers	259
201	Metal spinners	250*
227	File cutters (machine or hand)	250*
39	Edge tool grinders	230
210	Galvanisers and tinners	217†
288	Hair, etc., drafters; brush makers	214†
293	Glaziers	214†
308	Ticket collectors and examiners	214†
120	Hewers and getters (coal)	210
276	Coopers, hoop makers and benders	209†
203	Rivetters, caulkers	206
191	Iron or steel moulders and core makers	201
196	Forgemen, pressmen	200†

† Calculated on less than 50 deaths
* Calculated on less than 10 deaths

44. The previous sections of this report have used data on mortality and incapacity as indices of the extent of the problem in different sections of the population. This material is of little help in measuring the prevalence of the disease and, in order to fill this gap in knowledge, a number of studies have been carried out in random population samples in different areas. The results of these inquiries are summarised below.

General prevalence

45. Since the end of the Second World War a number of surveys have been carried out on random population samples and in selected occupational groups. The results of surveys in which comparable techniques have been used are summarised in Table 17 and relate only to men aged 55-64 years in the general population.

TABLE 17

Chronic bronchitis prevalence among men aged 55-64 years in general population samples

	Survey area	Number Sampled	Persistent cough and sputum (per cent.)	Chronic bronchitis* (per cent.)	Reference
Rural	Annandale (Scotland)	87	19.5	6.9	Higgins and Cochrane (1958)
	Vale of Glamorgan (Wales)	86	25.6	5.8	Higgins (1957)
	Rønne (Denmark)	156	9.0	2.6	Olsen and Gilson (1960)
Urban	Leigh (Lancashire)	84	17.9	10.7	Higgins et al (1956)
	Staveley (Derbyshire)	81	32.1	14.8	Higgins et al (1959)
	Rhondda Fach (Wales)	86	29.1	10.5	Higgins and Cochrane (1961)

* Persistent cough and sputum and at least one chest illness necessitating absence from work for at least one week during the previous three years.

TABLE 18

Prevalence of bronchitis among men and women aged 40-64 years (College of General Practitioners)

	Number Sampled		Bronchitis* prevalence (per cent.)	
	M	F	M	F
Rural	158	170	3	2
Small towns	355	332	7	2
Large towns	274	280	13	6

* Morning phlegm in winter, attacks of cough and phlegm lasting three weeks over the previous two years and breathlessness on the level.

While these surveys showed a substantial prevalence of persistent cough and sputum among men in this age group without any particular occupational risk, the rates were not consistently higher in the urban areas. On the other hand, the prevalence of "chronic bronchitis" as defined was always in excess among urban (10.5 to 14.8 per cent) compared with rural males (5.8 and 6.9 per cent) in Britain. This pattern has also been demonstrated by the survey carried out by the College of General Practitioners in the United Kingdom (1961). The latter results, summarised in Table 18, revealed a substantial excess of "bronchitis" among men in urban areas.

During 1955-6 a random population survey was carried out in Newcastle-upon-Tyne. In this study, reported by Ogilvie and Newell (1957), investigation was completed on 1,202 persons. Chronic bronchitis was defined as "a long-standing condition, the essential features of which are cough and sputum, persistent through the winter or throughout the year, in the absence of other causative respiratory illness." A minimum of two years was prescribed as essential for its recognition. Radiographic examination was performed to exclude other disease. The prevalence of chronic bronchitis among persons over 30 years of age was 36 per cent for men and 17 per cent for women. This male figure is substantially higher than that for chronic bronchitis illustrated in the studies in Table 17 and slightly in excess of the rate for persistent cough and sputum in the general population in other urban areas.

Prevalence in selected occupational groups

46. From the studies referred to in paragraph 45 above, and from separate inquiries among workers in the Post Office and the London Transport Executive, some information has been obtained about the prevalence of chest symptoms and recent chest illnesses in selected occupational groups. The results of comparable surveys are summarised in Table 19 for the separate occupations included. These findings, which are comparable with those of the corresponding surveys in Table 17, revealed a substantial excess in the prevalence of chronic

TABLE 19

Prevalence of chronic bronchitis among men aged 55-64 years in different occupational groups

Occupation	Number Sampled	Persistent cough and sputum (per cent.)	Chronic bronchitis (per cent.)	Reference
Mining and quarrying (Vale of Glamorgan)	29	24.1	24.1	Higgins (1957)
Farmers, etc. (Vale of Glamorgan)	38	15.8	5.3	Higgins (1957)
Mining* (Leigh)	101	37.6	26.7	Higgins et al (1956)
Mining* (Staveley)	96	39.6	18.8	Higgins et al (1959)
Foundry workers* (Staveley)	50	30.0	10.0	Higgins et al (1959)
Mining* (Rhondda Fach)	25	48.0	36.0	Higgins and Cochrane (1961)

* With no evidence of pneumoconiosis

bronchitis among workers in dusty industries. The only observations among those engaged in farming and allied occupations showed a lower prevalence of chronic bronchitis and persistent cough and sputum.

Fletcher et al (1959) and Fletcher and Tinker (1961) have reported on the prevalence of respiratory symptoms and ventilatory function among London postmen (G.P.O.) and employees of the London Transport Executive (L.T.E.) in the later years of working life. Table 20 summarises the findings of these two surveys in respect of cough and sputum and previous chest illnesses. In this summary "cough and phlegm" means a productive cough on most days for three months in the year.

TABLE 20

Prevalence of respiratory symptoms and chest illnesses among men aged 50-59 years (per cent.)

		G.P.O.	L.T.E.	Range in three other urban surveys reported in Table 17*
Number sampled			226	81—86
"Usual" cough and phlegm		29.2	Not stated	17.9—32.1
Bronchitic chest illnesses.†	One only	6.3	6.6	4.8— 8.6
	two or more	14.6	4.0	11.6—13.1

* Rhondda Fach, Staveley and Leigh
† During previous three years

The authors regard the particularly low frequency of recurrent chest illnesses among the L.T.E. employees by comparison with other urban surveys as being due possibly to the recruitment of fitter subjects and to differences in sick pay benefits and they express the view that only prospective studies will establish the incidence of recurrent bronchitis in these populations.

Prevalence among women

47. The prevalence of respiratory symptoms and chronic bronchitis has been recorded in a number of the surveys already reported in paragraph 45. The

TABLE 21

Prevalence of respiratory symptoms and chronic bronchitis among women aged 55-64 years (per cent.)
(Male rates shown in brackets for comparison)

Survey	Number Sampled	Persistent cough and sputum	Chronic Bronchitis	Reference
Rhondda Fach (urban—Wales)	173	9.8	6.9 (10.5)	Higgins and Cochrane (1961)
Vale of Glamorgan (rural—Wales)	92	7.6	4.3 (5.8)	Higgins (1957)
Annandale (rural—Scotland)	92	11.0	2.0 (6.9)	Higgins and Cochrane (1958)
General Practitioner Survey	305		5 (14)	College of General Practitioners (1961)

results of four of these studies, recorded in Table 21, show a substantially lower prevalence of both cough and sputum and "chronic bronchitis" among women compared with the rates experienced by men in the same areas.

Prevalence of chronic bronchitis by age

48. In a few of the studies already mentioned some information has been obtained regarding the prevalence of chronic bronchitis, as defined by the authors, among men in the older age groups. The results reproduced in Table 22 show the substantial increase in prevalence with advancing age. A similar but much less pronounced trend is observed among women.

TABLE 22

Prevalence of Chronic Bronchitis among men of different ages (per cent.)

	25-34	35-44	45-54	55-64	65+	References
Rhondda Fach (Non miners)	—	4.5	12.5	10.5	—	Higgins and Cochrane (1961)
General Practitioner Survey	—	3*	5	14	—	Coll. General Practitioners (1961)
Staveley†	1.8	—	—	14.8	—	Higgins et al (1959)
Glamorgan	2.2	4.2	8.9	10.3	15.6	Higgins (1957)

† Men in non-dusty industry
— Means information not collected
* Men aged 40-44 years

Bronchitis prevalence and social class

49. The survey carried out by the College of General Practitioners showed that chronic bronchitis was about three times as common among men belonging to social classes III, IV and V as among men in social classes I or II. In a study carried out in Birmingham, Brown et al (1957) showed a progressive increase in the prevalence of bronchitis up to social class V but pointed out that this association was only apparent among smokers. In a study of social class migration among male hospital patients in London Hospitals, Meadows (1961) showed that bronchitic patients showed a drift down the social class scale, especially during the years immediately before admission. The changes in social class were brought about mainly by changes in occupation which were probably due to sickness absence and increasing disability.

Aetiological Factors in Chronic Bronchitis

50. The importance of social and environmental factors in the causation of chronic bronchitis is implicit in three major characteristics of its distribution. These features are the differences in its geographical distribution particularly between town and country, variations in time in the frequency and severity of the disease and, above all, the steep gradient in mortality between the professional and managerial classes and the semi-skilled workers and labourers. Of the specific factors which have been considered as possible general environmental determinants of these features of chronic bronchitis air pollution, cigarette smoking and adverse climatic and domestic conditions seem to be the most relevant.

Atmospheric pollution

51. The effect of major fog incidents on mortality from bronchitis and from cardio-vascular diseases is well documented in Britain and other countries. In a report on the London fog of 1952 it was concluded that substances in the polluted fog caused irritation of the bronchi and bronchioles and accelerated death in those already suffering from diseases of the respiratory and cardio-vascular systems (Ministry of Health, 1954). In a review of the epidemiological studies of atmospheric pollution, Martin (1961) quotes the number of additional deaths resulting from five of the more important fog incidents in London between 1948 and 1959 at nearly 7,000, the greatest of these being 4,000 from the 1952 episode. Reporting on the effects of fog in London during 1958-1959 Martin and Bradley (1960) found a significant positive association between black suspended matter in the atmosphere and the daily number of deaths, a slightly less but still significant correlation between atmospheric sulphur dioxide and deaths and a significant negative association between visibility and deaths. Bronchitis deaths did not show as high a correlation with atmospheric conditions as did total deaths.

Stocks (1959) has shown highly significant correlations between the standardised mortality ratios from bronchitis and lung cancer and atmospheric pollution, measured by atmospheric deposit and smoke, in the County Boroughs of England and Wales and in the administrative areas of Lancashire and the West Riding of Yorkshire. In a study of bronchitis deaths among men of 45 years and over, Pemberton and Goldberg (1954) demonstrated a significant association between the sulphur dioxide content of the air and the mortality from this disease in County Boroughs in England and Wales. These workers failed to demonstrate significant correlations between sulphur dioxide air pollution and indices based on family income or housing. In their study of civil servants Fairbairn and Reid (1958) demonstrated a highly significant correlation between bronchitis mortality and the occurrence of fog based on visibility. They found that severe bronchitis causing disablement and death among postmen exposed by their job to atmospheric conditions was uniquely related to the frequency of thick fog and, presumably, to the level of air pollution. These rates in a group whose job and pay are uniform throughout the country run parallel to local bronchitis death rates in middle age. Variations in the latter were not related to population density or domestic overcrowding, and may thus be the result of a specific effect of air pollution on the respiratory tract. In their study of postmen permanently disabled or dying because of chronic bronchitis Reid and Fairbairn (1958) found that those men who had worked in the fog-ridden parts of Britain had suffered from a more severe form of the disease with more frequent sickness absence due to respiratory and circulatory complications than those in the less polluted areas.

Further evidence of the association between atmospheric pollution and bronchitis has been provided by Lawther (1958) and Henderson et al (1961). The subjective experience of bronchitis patients was found to be more closely correlated with changes in atmospheric pollution measured by daily recordings of sulphur dioxide and smoke than to any other factor during the winter months.

Smoking

52. Evidence has been accumulating incriminating cigarette smoking as an important factor in the ætiology of chronic bronchitis. According to Fletcher

(1959) the disease is seldom seen in men who have never smoked. Higgins (1959) showed a clear relationship between smoking and persistent cough and sputum in a study of 734 men between 25 and 64 years of age selected at random from urban and rural populations (Annandale, Glamorgan and Leigh). Smokers experienced more chest illnesses, wheezing, breathlessness and chronic bronchitis than non-smokers or ex-smokers. The prevalence of chronic bronchitis in males aged 56-64 years was 17.6 per cent among heavy smokers, and 13.9 per cent among light smokers compared with 4.4 per cent among ex-smokers and nil among non-smokers. Oswald and Medvei (1955), in a study of bronchitis prevalence among some 6,000 London Civil Servants, showed higher rates among smokers, the differences being greater among the younger than among the older employees. In their prospective study of mortality among medical practitioners Doll and Hill (1956) found a statistically significant gradient from non-smokers to smokers in the mortality rates due to chronic bronchitis. In the Newcastle survey reported by Ogilvie and Newell (1957), it was found that, when 464 bronchitics were compared with 485 non-bronchitic controls, the former were heavier smokers. Among both men and women the proportion of non-smokers at the time of the survey was 26 per cent among the controls and 11 per cent among the bronchitic patients. Brown and his co-workers (1957) produced similar results in a survey of about 1,000 older men in eleven general practices in Birmingham. Here the prevalence of bronchitis among smokers (31 per cent) was about twice the figure among non-smokers (15 per cent). In this study the social class gradient for bronchitis was apparent only for smokers, the prevalence rate progressively increasing from 20 per cent in classes I and II to 45.1 per cent in Social Class V. In a study of 2,000 policyholders of U.S. Government life insurance Dorn (1959) showed that cigarette smokers were subject to an increased risk of dying from lung cancer as well as from bronchitis and certain other diseases. The risk of dying from lung cancer was fifteen times and from bronchitis and related conditions more than three times greater among regular moderate to heavy smokers than among non-smokers.

Apart from the measurements of respiratory function made in the course of the epidemiological surveys already described, several comparisons have been made of the results of physiological tests in individuals and different smoking and clinical histories. In general, these studies showed a significant decrease in the ventilatory and diffusing capacity of the lungs of cigarette smokers below that of non-smokers of the same age and build (Wilson et al, 1960 and Martt, 1962). The effect seems to depend in part on the subject's age because, while it was not observed by McKee (1958) in young men whose average age was 25 years, Flick and Paton (1958) showed that the peak expiratory flow rate declined with age only among smokers.

The method of smoking also appears to be important. Olsen & Gilson (1960) showed that pipe and cigar smokers had a better respiratory performance than did cigarette smokers, a result consistent with Higgins (1959) report of fewer symptoms in the former group.

The immediate physiological effects of smoking cigarettes have been studied by Bickerman and Barach (1954) who demonstrated no significant change in the various measurements of ventilatory function but noted that seven out of the 118 normal and emphysematous or asthmatic subjects studied showed an increase in breathing capacity after the coughing stimulated by smoking. Rothfield et al (1961) reported similar findings. Eich et al (1957) and Attinger

et al (1956 and 1958) showed that smoking increased airway resistance but only among emphysematous patients. On the other hand, Nadel and Comroe (1961), using the body plethysmograph technique, were able to demonstrate an increase in airway resistance after cigarette smoking by patients and normal smokers and non-smokers.

Two sets of animal experiments may be noted. Loomis (1956) reported an increase in tracheal pressure after a 2-second puff of cigarette smoke into the lungs of guinea pigs. Of perhaps greater relevance to the aetiology of chronic bronchitis, however, is the demonstration by Falk et al (1959) of the slowing of the mucous stream by the action of particulate matter in cigarette smoke and nicotine in solution on the ciliated epithelium of the trachea. The findings of these laboratory and animal studies, although not unanimous, are broadly consistent with the evidence on the relationship of cigarette smoking to disabling symptoms found by field surveys.

This is the evidence on which the Sub-Committee bases its views on the importance of cigarette smoking.

Sex differences

53. Although atmospheric pollution and tobacco smoking are recognised as important factors determining the onset and progression of chronic bronchitis, they cannot account entirely for differences in prevalence. While Oswald and Medvei (1955) attributed the higher incidence among men to excess smoking, Fletcher and his co-workers (1959) found that, although the prevalence of cough and sputum was the same among heavy smokers of both sexes, women presented less marked secondary effects and did not show any significant depression of ventilatory capacity in association with productive cough. Fletcher (1959) believes that the sex differences may be due to the fact that women are less susceptible to the disabling consequences of bronchial hypersecretion than are men.

Social class differences

54. The steep rising gradient of mortality with declining social class has been commented upon in the Health Bulletin of the Chief Medical Officer of the Department of Health for Scotland (1960) and elsewhere. There is a close association between social class and the standardised mortality (20-65 years) and the proportionate mortality (65 years and over) ratios for England and Wales. Since this association is just as apparent for married women, whose social class is determined by their husbands' occupations, it is reasonable to assume that these observed differences are more likely to be environmental than occupational. Of the environmental factors involved, atmospheric pollution is one of the most likely causes of the excess mortality observed in the lower social classes who tend to live in the more polluted urban areas. The suggestion that overcrowding may be responsible, by increasing the risk of infection, does not receive any support from the studies of Fairbairn and Reid (1958) who were unable to show a significant association between regional differences in bronchitis mortality and overcrowding; but this problem needs further investigation. In the study carried out by the College of General Practitioners (1961) the differences in smoking habits were too small to explain the social class gradient in chronic bronchitis prevalence.

Urban-rural differences

55. Reference has been made to the substantially higher prevalence of (para. 45) and mortality from (para. 39) bronchitis among town dwellers and the relevance of this experience to the presence of atmospheric pollution has been discussed (para. 51).

Individual susceptibility

56. It seems that individual susceptibility may play some part in determining the onset and progress of bronchitis. Under apparently similar environmental conditions only a proportion of the population are affected. Not all smokers develop bronchitis—nor do all urban dwellers. On the other hand the disease can affect non-smokers who live in the country. The question of individual susceptibility requires further study.

Infection

57. There can be no doubt that infection plays an important part in the progression of this disease once the process has been established. How far infection, bacterial or viral, is instrumental in the initiation of the condition and how important this may be in maintaining the chronic state are matters requiring further study. Epidemics of influenza are invariably accompanied by substantial increases in bronchitis mortality. The seasonal swing in morbidity would be consistent with increased infection as well as atmospheric pollution. Contrary to common belief there is no evidence to incriminate catarrhal infections in infancy or childhood as more than a minor factor in determining the occurrence of chronic bronchitis in later life.

Temperature and climate

58. Much has been attributed to the British climate and to the habit of sleeping in cold unheated rooms but no evidence has yet been produced incriminating them as direct causal factors. Holland et al (1961) have shown that when the effect of general seasonal variations are removed there remains an association between the hospital admission rate from bronchitis and the outside temperature and that this is independent of concurrent changes in the levels of atmospheric pollution.

PART III

Chemotherapy, Chemoprophylaxis and Use of Vaccines

Introduction

59. It is uncertain whether infection plays any part in the initiation of the bronchitic process. Although a number of patients date the onset from an obvious acute respiratory infection, it seems likely that the infection has merely drawn attention to, and exacerbated, a mild bronchitic process which was already present. Current thinking suggests that the earliest manifestation of chronic bronchitis is an increased activity of the mucus secreting cells of the bronchial mucosa, due mainly to irritation from cigarette smoking and atmospheric pollution. This condition predisposes to infection, at first in exacerbations and later as a continuing process. The lung destruction, which accounts for the progressive disablement, is the result of repeated infections

producing bronchiolitis and patches of pneumonia, followed by resolution and scarring.

60. In general it has been assumed that the organisms which are commonly found in purulent sputum and which disappear under the influence of chemotherapy and with the conversion of the sputum to mucoid, are the likely cause of the attack. It is not certain how far the proliferation of respiratory bacteria is derived from organisms already present or from new infections. Most of the evidence identifies *H. influenzæ* and *Str. pneumoniæ* as the organisms which most frequently complicate chronic bronchitis. The frequency with which these are isolated depends partly on the techniques used. For *H. influenzæ* special media have to be employed. The isolation rate of *Str. pneumoniæ* is usually enhanced by mouse inoculation, perhaps by growth under carbon dioxide or by anærobic culture. Some of the literature involving bacterial investigations is summarised in Appendix VIII. It is possible that differences between the rate of isolation in different studies reflect partly differences in technique and perhaps also seasonal variations in the prevalence of the two most important bacterial species. The lowest figure of 15 per cent for the isolation of *H. influenzæ* was reported by Stuart-Harris and his co-workers in 1953 but they did not use any selective culture media. In the other studies recorded *H. influenzæ* was isolated from 26 to 90 per cent and *Str. pneumoniæ* from 15 to 72 per cent of cases. From their study of patients in 36 clinics in the United Kingdom Francis et al (1961) concluded that differences between the various centres were more likely to be due to bacteriological technique than to geography. Since *Str. pneumoniæ* are generally more susceptible to antibiotics than *H. influenzæ* it seems possible that seasonal variations in prevalence may account for some of the differences in the effectiveness of the various antibiotics in different trials.

61. The importance of viral infections in chronic bronchitis is uncertain. Exacerbations in patients with chronic bronchitis undoubtedly occur during influenza epidemics. Recent evidence suggests the possible importance of respiratory syncytial viruses in exacerbations of chronic bronchitis in Glasgow (Sommerville 1962). The possible role of the newly identified common cold viruses will certainly require elucidation. It is not known whether viruses persist in the respiratory tract between exacerbations.

Chemotherapy and Chemoprophylaxis

62. The use of drugs for the control of chronic bronchitis can, for practical purposes, be considered under two separate heads:—

(i) the treatment of the exacerbations (chemotherapy);

(ii) the prevention of the exacerbations (preventive chemotherapy).

Chemotherapy

63. The effect of chemotherapy on the exacerbations of the disease has not, generally speaking, been assessed by controlled trials. Some of the studies have been confined to patients with *H. influenzæ* in the sputum while others have not. The criteria of a successful outcome have usually included the conversion of the sputum from purulent to mucoid, sometimes the disappearance of bacteria thought to be causative and sometimes other clinical features. Some of the evidence, which includes only three controlled studies and is not very

impressive, is summarised in Appendix IX. Douglas et al (1957) cleared the pus from the sputum of 53 per cent of cases with intramuscular penicillin. The failures were randomised to treatment with tetracycline or chloramphenicol, both 1.0 g./day. Chloramphenicol appeared the better. The City General Hospital, Sheffield group (1958) treated severe exacerbations, in a controlled trial, either with chlortetracycline in an initial dose of 0.25 g. six times daily or with penicillin G in an initial dose of 0.2 mega units six-hourly. Chlortetracycline appeared to be the most successful agent but the dose of penicillin was small. Berry et al (1960) investigated the treatment of exacerbations in general practice, comparing the treatment of relatively mild attacks with oxytetracycline in small doses or with a placebo. Oxytetracycline proved significantly more effective in moderately severe but not in slight attacks.

Of the other papers none is very impressive except the systematic but uncontrolled study by Mulder et al (1952) who found, in purulent bronchitis with *H influenzæ*, that high doses of penicillin (at least 2 mega units a day), penicillin *plus* streptomycin, or chloramphenicol were all successful in a relatively high proportion of cases.

In general it seems that penicillin *plus* streptomycin, in doses comparable to Mulder's, or chloramphenicol are both highly effective in exacerbations of chronic bronchitis. The relative position of high dosage penicillin or the tetracyclines is still uncertain but both are likely to be successful in at least a proportion of cases. The position of ampicillin, highly effective against *H. influenzæ in vitro*, has not yet been established.

The risk of vestibular damage from streptomycin, especially in the old or in those with renal impairment, should be remembered. Although the blood dyscrasias are rare complications of treatment with chloramphenicol, the fact that they are frequently fatal when they do occur indicates that this drug should not be used for the treatment of exacerbations unless there are commanding reasons for using it among those who have failed to respond to other therapy.

Preventive chemotherapy

64. Preventive chemotherapy aims at the use of regular drug medication for those who are known to be suffering from chronic bronchitis and who are liable to severe infective exacerbations during periods of high risk. The object is to prevent these attacks or to reduce their severity and the period of incapacity from work.

The drugs investigated have been sulphonamides (sulphadimidine or a mixture of sulphonamides), oral penicillin (usually as phenoxymethyl penicillin) and one of the tetracyclines. In most trials these drugs have been given in small daily doses for several months, or throughout the winter, or continuously for a year. The results of certain controlled trials are summarised in Appendix X.

65. In two controlled trials, those of Kilpatrick and Oldham (1954) and Edwards et al (1957) no evidence was found that sulphonamide drugs were effective in preventing or shortening exacerbations of bronchitis. In the latter trial the sulphonamide alone was not superior to dummy tablets and the group given both oxytetracycline and sulphadimidine did no better than that given oxytetracycline only.

66. In trials of the preventive effect of oral penicillin (phenoxymethylpenicillin 500-524 mg. daily) Pridie et al (1960) and Francis and Spicer (1960)

found that penicillin was as successful as tetracycline, in a dose of 0.5 g. daily. The difference from the controls was not statistically significant in the first trial and in the second there was a significant reduction only in the duration of the exacerbations; daily penicillin and daily tetracycline seemed to be equally effective in halving the number of working days lost in comparison with the control groups. In the trial conducted by the Research Committee of the British Tuberculosis Association the results were so surprising that a further investigation was carried out during the winter of 1959/60 (Francis et al 1961). Continuous penicillin or tetracycline were given in the same doses as in the first trial, the control group receiving dummy tablets although their acute exacerbations were treated at random with oral penicillin or with tetracycline. Once more, the group receiving continuous prophylactic tetracycline halved the days lost from work compared with the controls, while those receiving continuous penicillin fared no better than the control group. The number of exacerbations was not reduced in any of the groups. But, perhaps surprisingly, those who received continuous tetracycline, or tetracycline only for exacerbations, showed significantly less loss of work from respiratory illnesses, other than pneumonia or bronchitis.

The carrier-rate of *H. influenzæ* was reduced by nearly 50 per cent in the group on continuous tetracycline, whereas it rose in the control group and in those on continuous penicillin. The pneumococcal carrier-rate was greatly reduced both in the group on continuous tetracycline and in that on continuous penicillin.

From the results of these trials it seems that oral penicillin in the doses used probably has a marginal effect owing to its influence on pneumococci, but this benefit is probably somewhat inferior to that of tetracycline used in a dose of 0.5 g. daily. No direct comparison has yet been made with tetracycline in a dose of 1.0 g. daily but, by extrapolation, penicillin would probably prove markedly inferior. The usual oral penicillins, therefore, cannot at present be recommended for prophylaxis. The new oral penicillin, ampicillin, which is highly effective *in vitro* against *H. influenzæ*, may prove of very much greater value, but this has not yet been established by controlled trial and the drug at present is very expensive.

67. The action of each type of tetracycline is probably similar and they have been grouped together in Appendix X. The evidence suggests that 0.5 g. tetracycline daily is probably less effective than 1.0 g. Although those receiving the smaller dosage fared better than the controls, the results were impressive only in the trial of Buchanan et al (1958). The British Tuberculosis Association trials (Francis and Spicer, 1960, Francis et al 1961) showed statistically significant shortening of the exacerbations but no diminished incidence. This advantage did not reach significance in the trial carried out by Pridie et al (1960), perhaps because the tablets were discontinued during the exacerbation. When tetracycline has been employed in a daily dose of 1.0 g. or more the advantage has proved statistically significant in three of the four trials which have been carried out by Edwards et al (1957), Moyes and Kershaw (1957), Edwards and Fear (1958) and Murdoch et al (1959).

In the study carried out by the British Tuberculosis Association during the spring of 1959 (Francis & Spicer, 1960) the number of days lost by each bronchitic patient was 6.8 among those taking penicillin and 7.5 among those taking tetracycline compared with 14.2 among those taking placebo in daily oral doses. In the subsequent trial carried out under the same direction (Spicer

et al, 1961) the mean loss of working time was 8.13 among those taking penicillin and 4.04 per hundred days' exposure among those taking tetracycline. There was no placebo group in this trial but if one expresses the results of the placebo group in the first trial in the same way the loss of work per hundred days' exposure would have been 12 days.

At present tetracycline, in doses of 0.5 g. twice daily or 0.25 g. four times daily, must be regarded as the regime of choice for the prevention and the reduction of the severity of exacerbations due to bronchitis among established bronchitics.

Drug resistance

68. Such evidence as is available does not suggest that drug resistance is as big a problem as might have been expected among patients under long term preventive chemotherapy. For instance, Buchanan et al (1958) found no tetracycline resistance in *H. influenzæ* or pneumococci isolated from patients under treatment. Pridie et al (1960) found no trend towards resistance to penicillin or tetracycline in *H. influenzæ*. In the extensive trial of oral tetracycline and oral penicillin by the British Tuberculosis Association group (Francis, May & Spicer, 1961) no change in the pattern of sensitivity to penicillin was found among the pneumococci and *H. influenzæ* isolated. In the patients treated with daily tetracycline there was a slight trend towards increased tetracycline resistance at the end of the trial, but the gradient was small and not statistically significant. In the earlier British Tuberculosis Association trial (Francis & Spicer, 1960) a study was made of staphylococci isolated from the anterior nares. The carrier rate in the controls rose slightly, between the beginning and end of the trial, from 9 per cent to 19 per cent, that in the penicillin-treated group fell from 31 per cent to 21 per cent with no evidence of an increased prevalence of penicillin-resistant cocci. In the tetracycline-treated group the carrier-rate also fell, from 24 per cent to 16 per cent, but all the eight strains of staphylococci isolated at the end of the trial were tetracycline-resistant. Of 151 patients in another study (Pridie et al 1960) only two harboured staphylococci in the sputum at the end of the trial. Neither strain was resistant to the drug used. Murdoch et al (1959) found no increase in staphylococcal nasal carriers and no increase in strains resistant to the oxytetracycline which their patients were receiving.

The cost of preventive chemotherapy

69. Francis and Spicer (1960) tried to assess the gains and losses from preventive chemotherapy. Over a four months period the average money losses per patient in terms of loss of earnings, national insurance payments etc. was £40 for the control group and £18 for the group given 0.5 g. of tetracycline daily. But the cost of the tetracycline was £32, so that on an overall assessment the average loss was £50 for the tetracycline group and £40 for the controls. This would be even more formidable with a dose of 1.0 g. daily, increasing the cost of the drug to £64, though there might have been further saving on loss of work. This assessment does not, of course, include any effect in preventing irreparable lung damage by exacerbations. Preventive treatment might enable patients to remain at productive work for longer periods of their lives, with very considerable further financial saving. It is probable that the high cost of tetracycline has inhibited its use in the prevention of the acute exacerbations of chronic bronchitis. While it is important that the search for

less expensive treatment should be vigorously pursued, it must be recognised that the use of tetracycline will lead to considerable reduction of incapacity, although at substantial cost.

Future Research

70. (i) Treatment of Exacerbations: There are relatively few well-designed comparative studies and further controlled studies are indicated. The treatment of choice has not yet been certainly determined; nor is it clear why one of the more successful treatments may fail in some cases. Failure might be due to the nature of the infection, the failure of the antibiotic to reach the organism or the failure of the patient's defences to assist in its elimination. Certain of these problems are being studied, but much more work is necessary.

(ii) Long-term Preventive Treatment: It seems that a daily dose of 1.0 g. tetracycline is better than 0.5 g., but no direct comparison has been made. It would be worth determining, from the purely scientific point of view, whether even higher doses would be more effective, though greater toxicity as well as greater cost, might prohibit their use on a large scale. Trials of demethylchlortetracycline and the new wide-spectrum oral penicillin (ampicillin) are also indicated. The Research Committee of the British Tuberculosis Association has now established excellent machinery for such co-operative studies. The Medical Research Council is carrying out a long-term controlled prophylactic trial in cases of mild chronic bronchitis continuing over several years and intended to determine whether deterioration of respiratory function can be prevented.

Summary

71. (i) The importance of *H. influenzæ* and pneumococci as complicating pathogens in chronic bronchitis seems now fairly well established.

(ii) Few well-controlled studies have been carried out on the treatment of acute exacerbations of chronic bronchitis. The value of intra-muscular benzyl penicillin *plus* streptomycin and of chloramphenicol seems assured but it is uncertain which is the best, either in general or in any particular case. Chloramphenicol should not be used as routine treatment because of the rare, but potentially lethal, complication of blood dyscrasia. Penicillin *plus* streptomycin is a useful treatment for exacerbations, at least in hospital where injections are easily given, but the potential effect of streptomycin on the vestibular apparatus must be borne in mind, especially in the elderly. In the treatment of exacerbations, the relative positions of high-dosage benzyl penicillin, of the tetracyclines and of ampicillin are still uncertain. All are successful in at least a proportion of cases, but further controlled trials are required to find out which is the best, either as a general routine or in particular types of infection.

(iii) There have been a number of well-controlled trials of continuous long-term chemotherapy on chronic bronchitis. The evidence suggests that the sulphonamides are ineffective and that oral penicillin has only a marginal effect. Tetracycline, 0.25 g. twice daily, has been effective in reducing periods off work in some trials but not in others. On the other hand when 1.0 g. or more of tetracycline was given daily, the advantages proved statistically significant in three of the four trials reviewed.

(iv) Although effective, preventive tetracycline is very expensive. When

its cost is assessed against immediate saving of earnings and of health insurances etc. its use does not necessarily lead to a net saving. But it is impossible to estimate both the long-term economic gain and the gain in the prevention of suffering. A plea is made for administrative action to reduce the cost of this valuable drug.

(v) Some of the problems awaiting solution have been reviewed above.

Use of Vaccines

72. Although no virus has yet been shown to play a direct part in the ætiology of chronic bronchitis it might be thought that viral influenza could predispose to exacerbations of bronchitis. A controlled trial on influenza vaccine was carried out in chronic bronchitis by the Medical Research Council and the British Tuberculosis Society (1959) during the pandemic of Asian influenza in 1957-58. A significant reduction in attack-rate of influenza was found in males inoculated with Asian vaccine early in the epidemic. The attack-rate was 5.9 per cent, compared with 14.8 and 16.9 per cent in those given control vaccines. No protection was shown in the smaller number of women. On the other hand, in both sexes there was no significant reduction in illnesses diagnosed as bronchitis. In males those receiving Asian vaccine had an attack-rate of 35.7 per cent, compared with 32.4 and 29.2 per cent in the control groups. Grouping together all respiratory illnesses (including influenza) the attack-rate was 74.0 per cent in men inoculated with Asian vaccine, compared with 75.4 and 84.2 per cent in the controls. There were fewer deaths among males given Asian vaccine but the difference was not significant (14 deaths compared with 18 and 21 in the control groups). There was no death following an influenzal attack, compared with 4 and 2 in the control groups.

73. On the other hand a double blind trial carried out by Howells and Tyler (1961) on a small group of bronchitics in a general practice in Wolverhampton showed an impressive advantage to the patients receiving influenzal vaccine (A.A2 & B strains). Among the 26 patients receiving vaccine there were in all 10 exacerbations whereas 29 controls receiving physiological saline experienced 24 exacerbations. Four of the exacerbations in the vaccinated and nine in the controls were associated with positive complement fixations tests to influenza but two of these in each group occurred in the first three weeks after inoculation. This trial was on small numbers and the results were in some respects puzzling. If all the exacerbations which occurred during the first three weeks are excluded, only 1 of the 26 vaccinated persons suffered exacerbation compared with 12 of the 29 unvaccinated persons. From the results of the serological tests performed it would appear that only 7 of these attacks, all among the unvaccinated, were associated with a positive complement fixation test to influenza. This would suggest that the vaccine not only protected against influenza but also reduced the frequency of exacerbations due to other causes. Since these results are in such clear contrast with those found in M.R.C./B.T.A. trial it would be wise to await further evidence.

At present one cannot regard the benefit of influenzal vaccine in chronic bronchitis as certainly established but there is clearly need for further work which is in fact being carried out. Meantime, in spite of the equivocal evidence, if the vaccine comes into general use it seems reasonable to include chronic bronchitics as one of the groups for which vaccination must be seriously considered.

74. In view of the probable importance of *H. influenzæ* Edwards et al (1957) used an autogenous vaccine of this organism as part of a double blind controlled trial in chronic bronchitis. There was no suggestion of any beneficial effect. Brown and Wilson (1959) conducted a similar trial with a stock *H. influenzæ* vaccine in factory workers, including many chronic bronchitics. Again there was no evidence of benefit. It is interesting that, on the contrary, Ritchie (1958) showed a significant reduction of "full colds" in an adult population given prophylactic autogenous vaccine containing all flora grown from the individual's saliva at the beginning of the season.

75. It must be concluded that, when trials of bacterial vaccine have been conducted in a properly controlled manner, no benefit has so far been shown in chronic bronchitis. But Ritchie's success with autogenous vaccines in the common cold suggests that further investigation is needed.

PART IV

Summary of evidence

76. Evidence was invited from the persons and organisations whose names are given in Appendix I. This evidence is summarised below.

Written Evidence

77. There were frequent references to the lack of an objective definition of bronchitis. The development of suitable ventilatory tests and the recent introduction of a standard questionnaire on respiratory symptoms (1960) by the M.R.C. Committee on the Aetiology of Bronchitis has gone some way towards better understanding. The Sub-Committee of the Scottish Tuberculosis Society accepted the definition suggested by Oswald (Recent Trends in Chronic Bronchitis, Published by Lloyd-Luke, 1958) namely that "chronic bronchitis is a chronic affection of the bronchi and bronchioles, having cough, sputum and breathlessness as its outstanding symptoms."

78. It was stated that chronic bronchitis was a problem mainly, but not exclusively, of urban communities, that its prevalence increased with advancing age, that it more frequently affected men and that it attacked particularly the lower economic classes.

79. Reference was made to the need for careful history taking and clinical examination in the diagnosis of the condition, a time consuming operation requiring the services of experienced physicians. The need for radiological examination, for the exclusion of other diseases, was stressed. Doubt was expressed regarding the value of the more advanced tests of respiratory function in the routine clinical management of the patient. It was thought that certain simple tests would suffice.

80. There was general agreement that atmospheric pollution and smoking, particularly cigarette smoking were major ætiological factors. In addition to these, reference was made to the comprehensive array of environmental and other conditions which are usually regarded as contributory elements. Much stress was placed on the importance of bacterial and possibly also of viral

infection, if not as a primary cause of bronchitis, at least on the course and progression of the disease. It was suggested that viral infection might be the main ætiological agent acting as a predisposing factor for bacterial and other multiple viral action with the production of classical symptoms. In this connection attention was drawn to the possibility that infections of the respiratory tract in childhood and adolescence might well be precursors of chronic bronchitis in later life. It was suggested that overcrowding at home and elsewhere may lead to the spread of respiratory infections and that this may, to some extent, account for the urban, occupational and social class differences in incidence. Climate was also thought to be of some possible importance in determining the relatively high prevalence of bronchitis—especially the cold, changeable and wet conditions so typical of British weather. Reference was also made to the fact that central heating was not provided on a scale sufficient to offset the disadvantages of climate. Attention was drawn to the occupational hazards involving dust and noxious fumes in certain industrial processes. The possible role of bronchial sensitivity and genetic predisposition as features of constitutional susceptibility were also mentioned.

81. For the diagnosis and treatment of bronchitis, attention was drawn to the important role which existing chest clinics could play and to the need for evening sessions to prevent unnecessary loss of working time. Therapy, including the use of drugs, should be tailored to individual requirements and should include breathing and remedial exercises which can suitably be carried out as group therapy. The use of simple tests of respiratory function for the evaluation of the condition and for the supervision of treatment was emphasised. The importance of short term hospitalisation, preferably in peripheral units, for selected patients was stressed. It was envisaged that long term institutional care, perhaps throughout the whole winter, might be required for some chronic bronchitics. Attention was also drawn to the need for facilities for rehabilitation, including the provision of sheltered employment.

82. So far as prevention is concerned there was agreement on the need to pursue the campaign for clean air and the propaganda against cigarette smoking. Reference was also made to the reduction of atmospheric pollution by dust and fumes in factories. It was suggested that breathing exercises for children at school would be of value. The place of drugs was not regarded as sufficiently clearly defined to recommend their general employment as preventive agents. The possible use of influenza vaccine as a prophylactic for chronic bronchitics was suggested.

83. On the question of fuller evaluation of the problem, reference was made to the importance attached to epidemiological studies designed to elucidate further the contributory environmental and other causes. The view was expressed that future work in this field in Scotland should be prospective rather than retrospective. It was regarded as important to study further the natural history of bronchitis and to assess, for example, the influence of childhood infections (the 'catarrhal child') and of waves of viral and bacterial infection on the initiation, evolution and maintenance of the condition. These would require to be associated with the appropriate laboratory investigations. Further suggestions included the study of the pulmonary circulation and the pathological and histological findings in fatal cases. Consideration should be given to the carrying out of prevalence surveys on the lines already followed in some English and Welsh areas.

(a) Virology—Dr. N. R. Grist, Ruchill Hospital, Glasgow;
Dr. R. G. Sommerville, Belvidere Hospital, Glasgow;
and Dr. T. Sommerville, Queen's College, Dundee.

84. It is difficult to say how relevant virology is to the study of bronchitis. Acute exacerbations are frequently associated with influenza-like illnesses which have been investigated virologically.

Chronic bronchitis is not strictly a disease but a syndrome in which many ætiological factors are involved, including viral and bacterial infection. Little is known about the viral component beyond its possible influence in the acute phases. A difficulty is the prolonged 'incubation period.' Attempts need to be made to identify the different agents which may be associated with recurrent attacks and the influence of these on the progression of the disease.

85. A three-fold programme was suggested:

(a) a selected population should be studied over a number of years to ascertain the different types of viral and bacterial infections which are related to bronchitis in its latent and active phases,

(b) an effort should be made to determine the causes of relapse or superinfection, and

(c) a serological study of the antibody response in known cases of bronchitis.

The emphasis would be on a long term enquiry and would undoubtedly require careful planning and considerable financial backing. The technical side might be undertaken on an all Scottish basis.

86. It was appreciated that it would be a formidable task to undertake a follow-up of all bronchitics and it was suggested that much of this work could be carried out in an industrial community with a fairly static population. With the help of a good industrial medical officer, the assessment work could be carried out at the industrial clinic and a good liaison could be established between the laboratory, the clinician and the patient. People who have had a spell of bronchitis are not willing to or cannot, on their return to work, report to hospitals or clinics but can and will go to a works clinic. The jute industry in Dundee is well geared for such studies. Employees who move from one mill to another still come under the same industrial medical officer.

The virologists would be most willing to help in an enquiry of this kind but stressed that the viral and bacterial aspects should be studied together since most cases are associated with mixed infections.

87. It was suggested that the virologists and bacteriologists of the four Scottish Centres might get together and discuss what facilities are available, what has been done and what could be done in the field of research. Each centre might be able to consider a separate question. One centre might, for instance, consider a tissue study using material from biopsies, lobectomies and post mortems.

88. On the question of prophylaxis it appeared that there was no clear association between the bacterial and viral (H. influenza and adenovirus) population and drug therapy although there may be a clinical correlation with the patient's condition. As far as influenza vaccine was concerned the Medical Research Council were planning an extension of their trials.

89. Reference was made to the influence of lung damage by such conditions

as whooping cough and tuberculosis in early life. It might be that this damage led to the development of a focal point for infection in later years and that this might precipitate bronchitis.

90. The discussions indicated that there is a gap in the field of virology relevant to bronchitis. There might be a great deal to be discovered in this field. Further study should be encouraged.

91. It is clear that, although some work has been done on virology in relation to bronchitis, a great deal more study is required before the importance of viral infection as an individual entity or in association with other ætiological factors, can be properly evaluated. There is little doubt that viral infections are important in the acute exacerbations of the disease and it may be that these are equally important in maintaining or causing progression of the basic process. The further study of this question is a formidable task and will probably require the attention of a number of workers dealing with different facets of the problem as part of a combined and co-ordinated effort. Work in this field will require the co-operation of clinical and laboratory specialists in many disciplines.

(b) Pædiatrics—Professor R. W. B. Ellis, University of Edinburgh;
Professor J. H. Hutchison, University of Glasgow;
and Professor A. Mair, Queen's College, Dundee.

92. Since it had been suggested by some workers that some childhood illnesses, particularly the catarrhal conditions, might lay the foundation for the occurrence of chronic bronchitis in adult life, the views of representatives from the pædiatric service were invited. It was desirable to know whether this view was supported by evidence and, if not, whether it was possible to take steps to ascertain the facts.

93. Professor Ellis and Professor Hutchison both doubted whether this suggestion had any substance but agreed that there was no reliable information to support or refute it. It was their impression that few 'catarrhal' children, that is those suffering from sino-bronchitis, failed to overcome this syndrome before reaching adult life. Reference was made to four conditions which started in childhood and which would be likely to promote the occurrence of chronic bronchitis at a later date. These were (i) fibrocystic disease of the pancreas in which those children who survived into adult life would continue to suffer from chronic bronchitis or bronchiectasis, (ii) asthma, (iii) hypogammaglobulinæmia which may determine the occurrence of bronchitis as well as other infections, and (iv) adenovirus infections producing recurrent atelectasis. Although these conditions might contribute to the development of chronic bronchitis in later life it was agreed that they could account for only a small part of the problem.

94. While the pædiatricians thought that little of the chronic bronchitis in adult life could be attributed to diseases or infections in childhood they agreed that their views were based entirely on clinical impressions. The question could be settled only by a prospective study in which a satisfactory clinical classification was adopted at the outset. There would be many difficulties involved, not the least being the very long period of follow-up which would be necessary. The study of retrospective data was not likely to assist in resolving this question.

95. Professor Mair said he was interested in bronchitis and that an opportunity had occurred for him to follow-up the children examined in St. Andrews by the late Sir James Mackenzie. He had studied the case histories of these children and followed up 114 recorded as 'catarrhal' and 181 controls. Since this amounted to rather less than half of the total he felt that the potential of the study had been exhausted. He had been able to trace 87 per cent and obtain the co-operation of 66 per cent of those children whose original examination took place between 1920 and 1927. His findings, based on the bronchitis questionnaire (MRC) and ventilatory tests in a proportion of those interviewed, were inconclusive. While, on the whole, 'catarrhal' children seemed more prone to bronchitis in later life the difference was not significant. The study showed that substantial movements between social classes had occurred.

96. The view was expressed that childhood diseases or infections did not predispose to chronic bronchitis in later life in more than a small proportion of cases. Retrospective studies of the kind carried out by Professor Mair were thought to be of value provided the original records were sufficiently carefully compiled and capable of interpretation and provided also the persons could be followed up effectively. On balance, however, it was considered that only a prospective inquiry would effectively answer the question. Whether such a study was worth while in view of the difficulties involved was open to question.

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APPENDIX I

NAMES OF PERSONS (AND ORGANIZATIONS) INVITED TO GIVE EVIDENCE

ALSTEAD, Professor S.	Department of Materia Medica, University of Glasgow
ANDERSON, Professor T.	Department of Infectious Diseases, University of Glasgow
BACKETT, Professor E. M.	Department of Social Medicine, University of Aberdeen
BELL, Professor G. H.	Department of Physiology, Queen's College, Dundee
BROTHERSTON, Professor J. H. F.	Department of Public Health and Social Medicine, University of Edinburgh
BROWNING, Dr G. G.	Western Infirmary, Glasgow
CAPPELL, Professor D. F.	Department of Pathology, University of Glasgow
CRUICKSHANK, Professor R.	Department of Bacteriology, University of Edinburgh
DAVIS, Professor L. J.	Department of Medicine, Royal Infirmary, Glasgow
DOIG, Dr A. T.	Factory Department, Ministry of Labour and National Service, Glasgow
ELLIS, Professor R. W. B.*	Department of Child Life and Health, University of Edinburgh
FERGUSON, Professor T.	Department of Public Health, University of Glasgow
FULLERTON, Professor H. W.	Department of Medicine, University of Aberdeen
GARRY, Professor R. C.	Department of Physiology, University of Glasgow
GRANT, Dr. I. W. B.	Northern General Hospital, Edinburgh
GRIST, Dr. N. R.*	Virus Laboratory, Ruchill Hospital, Glasgow
HILL, Professor I. G. W.	Department of Medicine, Queen's College, Dundee
HORNE, Dr. W. A.	Medical Officer of Health, Glasgow
HOWIE, Professor J. W.	Department of Bacteriology, University of Glasgow
HUTCHISON, Professor J. H.*	Department of Child Health, University of Glasgow
LEES, Dr. A. W.	Ruchill Hospital, Glasgow
LENDRUM, Professor A.	Department of Pathology, Queen's College, Dundee
MAIR, Professor A.*	Department of Public Health and Social Medicine, Queen's College, Dundee
MALCOLM, Professor J. L.	Department of Physiology, University of Aberdeen
MONTGOMERY, Professor G. R.	Department of Pathology, University of Edinburgh
MURRAY, Dr. W. A.	East Fortune Hospital, East Lothian
MACDONALD, Professor A.	Department of Bacteriology, University of Aberdeen
MACQUEEN, Dr. I. A. G.	Medical Officer of Health, Aberdeen
McNEILL, Dr. R.	Maryfield Hospital, Dundee
SEILER, Dr. H. E.	Medical Officer of Health, Edinburgh
SOMMERVILLE, Dr. R. G.*	Virology Department, Belvidere Hospital, Glasgow
SOMMERVILLE, Dr. T.*	Department of Bacteriology, Queen's College, Dundee
SYMINGTON, Professor T.	Department of Pathology, University of Glasgow
TULLOCH, Professor W. J.	Department of Bacteriology, Queen's College, Dundee
WAYNE, Professor E. J.	Department of Medicine, University of Glasgow
WHITTERIDGE, Professor D.	Department of Physiology, University of Edinburgh
YOUNG, Professor J. S.	Department of Pathology, University of Aberdeen

COLLEGE OF GENERAL PRACTITIONERS,
Scottish Office, Edinburgh

SOCIETY OF MEDICAL OFFICERS OF HEALTH

TUBERCULOSIS SOCIETY OF SCOTLAND†
(now the Scottish Thoracic Society)

* Oral evidence.

† Evidence submitted by a Sub-Committee of the Council (Dr R. Cuthbert, Dr Sinclair Kennedy and Dr W. A. Murray).

APPENDIX II

Deaths from Selected Causes in Scotland

Number, rate and proportion of deaths from all causes 1960

Causes of Death (international list No.)			All ages			45-64 years		
			Deaths	Crude Rate /100,000	Per cent. of all deaths	Deaths	Crude Rate /100,000	Per cent. of all deaths
Heart Disease	(410-443)	M	10,983	438	35	3,561	603	38
		F	10,390	385	35	1,639	246	28
Arteriosclerosis and degenerative heart disease	(420-422)	M	9,904	395	31	3,257	551	34
		F	8,676	321	29	1,252	188	21
Coronary thrombosis	(420.1, 2)	M	6,713	268	21	2,941	498	31
		F	4,049	150	13	980	147	17
Malignant Neoplasms	(140-205)	M	5,815	232	18	2,438	413	26
		F	5,218	193	17	1,939	291	33
Respiratory neoplasms	(160-165)	M	2,160	86	7	1,203	204	13
		F	389	14	1	175	26	3
Vascular Lesions of Central Nervous System	(330-334)	M	4,206	168	13	830	140	9
		F	5,644	209	19	836	125	14
Bronchitis	(500-502)	M	1,589	63	5	579	98	6
		F	625	23	2	110	16	2
Tuberculosis—all forms	(001-019)	M	354	14	1	168	28	2
		F	155	6	1	43	6	1
All Causes		M	31,682	1,264		9,467	1,602	
		F	30,082	1,113		5,886	883	

Source: Registrar General for Scotland

APPENDIX III

Bronchitis Death Rates per 100,000 Population in Scotland by Age and Sex

	1921-3		1931-3		1941-3		1951-3		1954		1955		1956		1957		1958		1959		1960	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
0	196	159	100	82	76	49	14	10	9	13	11	10	13	8	8	6	12	9	11	8	12	12
5—	4	3	1	3	2	1	1	1	–	–	1	–	0	–	1	–	–	1	–	0	1	0
10—	2	2	1	1	0	0	–	–	1	–	2	–	–	–	0	–	0	–	0	–	–	0
15—	3	2	3	2	3	2	1	1	1	1	1	–	1	1	–	–	0	–	1	1	1	1
25—	8	6	5	5	6	3	2	1	1	1	1	1	1	1	2	1	1	3	2	1	–	2
35—	20	18	22	12	19	6	8	4	7	3	9	4	8	5	6	2	7	4	10	3	4	3
45—	66	41	56	31	71	18	47	12	43	10	54	8	43	9	42	9	50	11	55	11	37	9
55—	203	139	124	88	134	53	152	35	150	34	169	27	164	32	177	30	196	39	202	38	178	25
65—	584	483	444	311	263	164	260	101	248	81	297	100	325	89	318	88	387	81	411	116	397	86
75—	1,347	1,170	1,158	991	732	524	489	330	404	238	453	278	477	233	429	206	456	215	562	263	528	207
85+	2,084	2,284	2,262	2,694	1,766	1,663	951	825	850	584	725	574	901	585	850	490	762	510	758	590	707	444
All Ages Crude	90	83	74	69	63	44	53	29	49	24	57	26	58	24	57	22	65	25	71	29	63	23
*Standardised	136	109	104	82	78	46	58	26	53	20	61	22	62	20	61	18	69	21	75	21	68	19
All Ages—Persons	86		71		53		41		36		41		40		39		44		49		43	
*Standardised	121		92		60		40		35		39		39		37		42		47		40	

* Standardised to 1951 population.

0 means a rate of less than 1
— means there were no deaths
Source: Registrar General for Scotland

APPENDIX IV

Death Rates from Bronchitis and from All Causes in Selected European Countries in 1957-1960 Rates per 100,000

	Bronchitis Death Rates in 1958						Bronchitis Death Rates		
	Both Sexes	M	F	M F	Death Rate All causes	As a percentage of death rate from all causes	1957	1959	1960
England and Wales	65.2	93.5	38.8	2.4	1,170	5.6	60.0	64.0	57.9
Scotland	44.4	64.9	25.4	2.6	1,200	3.7	39.1	48.8	42.5
Northern Ireland	38.4	52.7	24.9	2.1	1,080	3.6	36.9	40.3	40.9
Eire	36.2	43.8	28.4	1.5	1,200	3.0	36.2	39.7	36.7
Portugal	22.3	27.3	17.1	1.6	1,020	2.2	25.1	23.7	24.5
Italy	20.9	24.9	17.1	1.5	940	0.2		22.6	†
Belgium	17.4	24.8	10.1	2.5	1,170	1.5	19.7	14.7	†
Netherlands	12.5	17.3	7.7	2.2	750	1.7	12.2	10.4	10.5
Luxembourg	8.8	12.3	5.1	2.4	1,100	0.8	7.3	†	†
Austria	8.5	11.2	6.2	1.8	1,220	0.7	8.6	9.5	8.7
Czechoslovakia	7.3	9.1	5.5	1.7	930	0.8		9.7	†
Iceland	5.9	7.1	4.8	1.5	690	0.9	4.2	2.9	4.6
Switzerland	5.4	6.9	3.9	1.8	960	0.6	6.5	5.2	†
Denmark	5.0	5.6	4.3	1.3	920	0.5	6.2	6.3	†
Hungary	4.5	5.8	3.3	1.8	990	0.5	5.5	4.6	5.4
France	4.5	5.5	3.6	1.5	1,120	0.4	4.6	3.9	4.3
Norway	4.5	4.8	4.2	1.1	900	0.5	4.2	4.7	†
Sweden	4.3	3.9	4.7	0.8	960	0.4	3.8	3.9	4.9
Greece	4.1	4.4	3.7	1.2	710	0.6	3.8	4.2	†
Finland	3.7	5.5	1.9	2.9	890	0.4	3.4	3.6	3.7
Poland	2.9	3.2	2.7	1.2	840	0.3	3.2	2.9	†

Source: Annual Epidemiological and Vital Statistics, 1958 (1961) and Epidemiological and Vital Statistics Reports (1961 . 14 . 1 . 30 and 1962 . 15 . 288) of the World Health Organisation.

† Data not available.

APPENDIX V

Bronchitis Death Rates in Selected Countries during 1958

Rates per 100,000 by Age and Sex over 34 years

Age—Years		35—	40—	45—	50—	55—	60—	65—	70—	75—	80—	85+	All Ages	Both sexes
Scotland	M	4.6	9.0	27.7	74.3	150.2	258.7	373.8	404.9	421.3	522.5	764.7	64.9	44.4
	F	3.3	5.4	10.9	11.5	27.7	53.0	74.5	112.6	183.5	272.0	509.7	25.4	
England	M	3.8	10.4	23.8	64.0	147.3	279.2	431.0	635.1	798.5	1064.3	1375.0	93.5	65.2
and Wales	F	2.3	3.9	7.6	12.9	27.9	51.7	87.0	153.4	265.6	458.2	797.3	38.8	
Norway	M	—	0.8	0.8	3.8	4.2	7.3	25.9	11.0	29.1	47.9	202.0	4.8	4.5
	F	0.8	—	0.8	—	—	5.6	6.9	12.4	35.4	41.7	182.5	4.2	
Denmark	M	—	—	—	2.9	4.2	7.8	8.8	19.3	38.9	131.2	299.0	5.6	5.0
	F	—	—	1.3	—	2.3	1.8	5.5	16.7	42.3	82.7	211.4	4.3	
Belgium	M	0.6	3.6	6.4	14.5	34.2	68.1	116.8	150.8	198.7	235.8	391.1	24.8	17.4
	F	0.6	1.6	0.6	2.2	8.1	8.6	15.2	44.3	78.0	152.2	245.3	10.1.	
France	M	0.2	0.8	0.5	2.0	4.2	11.5	18.4	30.3	67.4	96.1	151.5	5.5	4.5
	F	0.1	0.1	0.4	0.5	0.8	1.6	5.0	10.4	21.9	51.3	102.1	3.6	
U.S.A.	M	0.2	0.5	0.9	2.3	4.3	8.8	14.0	16.2	19.1	29.0	45.2	3.1	2.3
(White)	F	0.2	0.4	0.5	0.5	1.2	1.4	2.4	3.6	7.7	13.6	30.3	1.4	

— Rate negligible

Source: Annual Epidemiological and Vital Statistics, 1958. World Health Organisation (1961)

APPENDIX VI

Bronchitis Deaths and Crude Death Rates in Scotland in Different Aggregations of Administrative Districts 1958-60

		Cities	Large Burghs	Counties (ex Cities and Large Burghs)	Small Burghs	Landward	Scotland
1958	Deaths	1,196	350	748	306	442	2,294
	Rate/100,000	63	40	31	35	29	44
1959	Deaths	1,363	412	781	307	474	2,556
	Rate/100,000	71	47	33	35	31	49
1960	Deaths	1,078	369	767	316	451	2,214
	Rate/100,000	56	42	32	36	29	43

Source: Registrar General for Scotland

APPENDIX VII

Chronic Bronchitis

Total Deaths for 1958-1960 (inclusive)

Average Annual Crude Death Rate per 100,000

Cities and Large Burghs	Deaths	Rate
Aberdeen	221	37.6
Airdrie	39	30.9
Arbroath	22	36.5
Ayr	58	43.6
Clydebank	52	33.7
Coatbridge	68	42.2
Dumbarton	32	39.6
Dumfries	39	46.8
Dundee	225	41.4
Dunfermline	56	39.9
Edinburgh	694	49.3
Falkirk	69	61.3
Glasgow	2,507	77.8
Greenock	103	44.8
Hamilton	63	50.4
Inverness	18	21.0
Kilmarnock	61	44.4
Kirkcaldy	44	28.0
Motherwell and Wishaw	117	53.6
Paisley	151	52.0
Perth	45	36.5
Port Glasgow	24	34.0
Rutherglen	40	54.1
Stirling	28	34.3

Counties	Deaths	Rate
Aberdeen	114	27.4
Angus	60	25.9
Argyll	57	33.8
Ayr	236	31.1
Banff	35	23.8
Berwick	25	35.6
Bute	22	49.7
Caithness	17	21.5
Clackmannan	50	40.5
Dumfries	50	26.9
Dunbarton	105	34.3
East Lothian	41	26.2
Fife	234	34.7
Inverness	26	15.9
Kincardine	25	31.2
Kirkcudbright	28	30.7
Lanark	424	42.9
Midlothian	99	30.3
Moray	38	25.4
Nairn	3	12.1
Orkney	10	17.3
Peebles	18	42.7
Perth and Kinross	65	23.4
Renfrew	164	39.4
Ross and Cromarty	37	20.9
Roxburgh	35	26.1
Selkirk	29	46.2
Stirling	119	30.7
Sutherland	10	26.0
West Lothian	92	32.7
Wigtown	19	20.9
Zetland	9	16.5

APPENDIX VIII

Bacteriology of Chronic Bronchitis and Bronchiectasis

Authors	Date	Country	Disease	No. of Patients	H. infl.	Pneumo-coccus	Other Pathogens	Remarks
Mulder	1938	Netherlands Sumatra	Supp. bronchitis or tracheitis	205	90–100%			Slight variation in different sub-groups.
Allison et al	1943	Leeds, England	Bronchiectasis	100	63%	14%	Staph. in 14%	Bronchoscopic aspiration
Franklin & Garrod	1953	London, England	Bronchiectasis in children	36	97%	28%	Nil	Pneumococci: scanty except in 1 case.
Stuart-Harris et al	1953	Sheffield, England	Chr. Bronchitis	172	15%	50.5%	Str. haem 4.6% Staph. 11.6%	No special medium for H. infl.
May	1953 (i)	London, England	Chr. Bronchitis	54	26%	57%	Staph. 13%	
May	1953 (ii)	London, England	Chr. Bronchitis	22	64%	72%	Staph. 14%	Disappearance of pus coincided with disappearance of H. infl. or Str. pneum.
Elmes et al	1953	London, England	Chr. Bronchitis	13	62%	15%		
Helm et al	1954	London, England	Chr. Bronchitis	17	94%			
May & Oswald	1956	London, England	Chr. Bronchitis	37	92%			
Edwards et al	1957	Leeds, England	Chr. Bronchitis	320	65.4%	39.7%	Friedländer 11.5%	Figures for purulent sputum only.

APPENDIX VIII (Contd.)

Authors	Date	Country	Disease	No. of Patients	H. infl.	Pneumo-coccus	Other Pathogens	Remarks
Brumfitt et al	1957	London, England	Chr. Bronchitis	27	66%	15%	Str. haem 4.5%	Includes 8 with carcinoma and 5 with bronchiectasis. All *bronchoscopy* specimens.
City General Hospital, Sheffield	1958	Sheffield, England	Chr. Bronchitis	84	42%	61%		
Buchanan et al	1958	Glasgow, Scotland	Chr. Bronchitis	21	81%	38%	Friedländer 9.5% Staph. 9.5%	Controls, untreated.
Lees & McNaught	1959	Glasgow, Scotland	Chr. Bronchitis & Tuberculosis	16	50%	37%	Staph. 6.3%	All *bronchoscopy* specimens.
Murdoch et al	1959	Edinburgh, Scotland	Chr. Bronchitis	1. ?11 2. ?40	40% 58%	55% 37%	Staph. 21% Staph. 4% Str. haem 2%	Purulent sputum only. Purulent sputum only.
Pridie et al	1960	London, England	Chr. Bronchitis	90	27%	18%	Staph. 3.5%	Cyclostyled note specially obtained.
Francis, May & Spicer	1961	U.K. various centres	Chr. Bronchitis	405	29%	41%	Not assessed	Many laboratories involved. Variations between clinics in H. infl. isolation attributed to techniques.

NOTE.—A blank space means that the method was not employed or that the information is not available or is not in a suitable form.

APPENDIX IX

CHEMOTHERAPY OF EXACERBATIONS OF CHRONIC BRONCHITIS

Authors	Type of Trial	No. of Patients	Bacterio-logical studies	Criteria of Sputum			Effect	Drugs and Doses	Remarks
				Vol.	Pus.	Bact.	Clinical		
Mulder (1952)	Not controlled	125	All with H. infl.	+	+	+	+	1. Penicillin inhalation 2 x 0.2 meg./day 2. Pen.i.m. (a) 1 x 10^6 (b) 2 x 10^6 (c) 4 x 10^6 3. Sm.0.2–0.5g x 4–6/day 4. Pen.4 x 10^6 10 days +Sm. 4 x 0.5 g. 5 days 5. Chloramphenicol 0.5 x 4/day 6. Chlortetracycline or oxytetracycline (no dose given)	1. Success in 3/4: Not in smaller doses 2. (a) Success 0/3 (b) Success 3/4 (c) Success 8/10 + 1 partial 3. Success 8/11: Drug resistance in rest 4. Success 50/66 Complete 11/66 Partial Failed 5/66 5. Success 14/15 Relapse common 6. Success 7/11
Elmes et al (1953)	Not controlled	13	H. infl. 8/13 Str. Pneum. 2/13	0	+	+	+	1. Pen. 0.2 x 10^6 x 6/day p.o. 2. Chloramph. 0.5 x 4/day 7 days 3. Chlortetra. 0.5 x 4/day 5 days 4. Sulphadimidine 1 g. x 4/day 7 days	Temporary reduction of bacteria and pus. Relapse when stopped 4. No effect
May (1953)	Not Controlled	39	+	+	+	+	0	1. Penicillin 2. Chloramphenicol 3. Sm.	1. Successful pneumococci 2. Successful H. infl. 3. Successful 4/5 H. infl. Relapse common with H. infl.

APPENDIX IX (Contd.)

Authors	Type of Trial	No. of Patients	Bacterio-logical studies	Criteria of Sputum			Effect	Drugs and Doses	Remarks
				Vol.	Pus.	Bact.	Clinical		
Helm et al (1954)	Not controlled	17	+	+	+	+	+	Oxytetracycline 1 – 3 g./day	Success 15/17. Little detail
Douglas et al (1957)	Controlled in Pen. failures	89	Routine only		+			(1) Pen. 1–2 x 10^6/day Failures randomised to (2) Tetracycline 1g./day or (3) Chloramph. 1g./day	(1) Success 53% (2) Success 6/19 (3) Success 9/11
Berry et al (1960)	Controlled Double Blind	58	0	+	+	0	+	(1) Lactose or (2) Oxytetracycline 0.25 g. t.d.s. 5 days	More rapid recovery and less deterioration in (2) Significant for moderately severe but not for mild attacks

APPENDIX X

Controlled Trials of Preventive Chemotherapy in Chronic Bronchitis

Authors	No. of Patients	Tetracycline Dose	Sulphonamide Dose	Oral Penicillin Dose	Exacerbations						Remarks
					Less frequent			Shorter			
					Tetra	Sulph.	Pen.	Tetra	Sulph.	Pen.	
Kilpatrick & Oldham (1954)	83	None	0.5 g. t.d.s.	None		0					
McVay & Sprunt (1953)	30	0.25 g. b.d.	None	None	±						Cases not allocated at random. Method of assessment doubtful
Buchanan et al (1958)	36	0.25 g. b.d.	None	None	+						
Pridie et al (1960)	151	0.5 g. ? once daily	20 g. with phenoxymethyl pen. 500 mg. ? once daily		±	±		±	±		Slight differences only Not significant at 5%
Francis & Spicer (1960)	252	0.25 g. b.d.	None	Phenoxymethyl 312 mg. bd.	0		0	+		+	
Francis, May & Spicer (1961)	533	Ditto	None	Ditto	0		0	+		+	Tetra. better than penicillin control
Moyes & Kershaw (1957)	90	0.5 g. t.d.s. 1/52 then 0.25 g. t.d.s.	None	None	±			0			
Murdoch et al (1959)	75	0.25 g. q.d.s.	None	None	+			Not assessed			

APPENDIX X (Contd.)

Authors	No. of Patients	Tetracycline Dose	Sulphonamide Dose	Oral Penicillin Dose	Exacerbations						Remarks
					Less frequent			Sborter			
					Tetra	Sulpb.	Pen.	Tetra	Sulpb.	Pen.	
Edwards et al (1957)	66	1-1.5 g. or otber adjusted clinically in 'divided doses.' Usually 0.5 g. b.d.	1-1.5 g. or other adjusted clinically in 'divided doses.' Usually 0.5 g. b.d.	None	+	0		+	0		1. All bad H. infl. in sputum 2. 3rd group on tetra + sulph. similar to tetra 3. Exacerbations included in overall assessment: not analysed separately
Edwards & Fear (1958)	29	1-1.5 g. or other adjusted clinically in 'divided doses.' Usually 0.5 g. b.d.	None	None	+						Over 18/12 no relapse in 14 tetra but relapse in 11/15 controls wbo stopped treatment and changed to dummies after first trial

Note 1. In each of the above a control group was given dummy tablets. Most trials were "double blind."
Note 2. 0=No apparent effect. ± Difference from control (dummy) group but not statistically significant.

+=Statistically significant difference from control (dummy) group. N.A.=Not applicable.
A blank space means that the method was not employed or tbat the information is not available or is not in a suitable form.

Figure 1.

Bronchitis Death Rates for Males oged 35-74 years. Scotland 1921-1960.

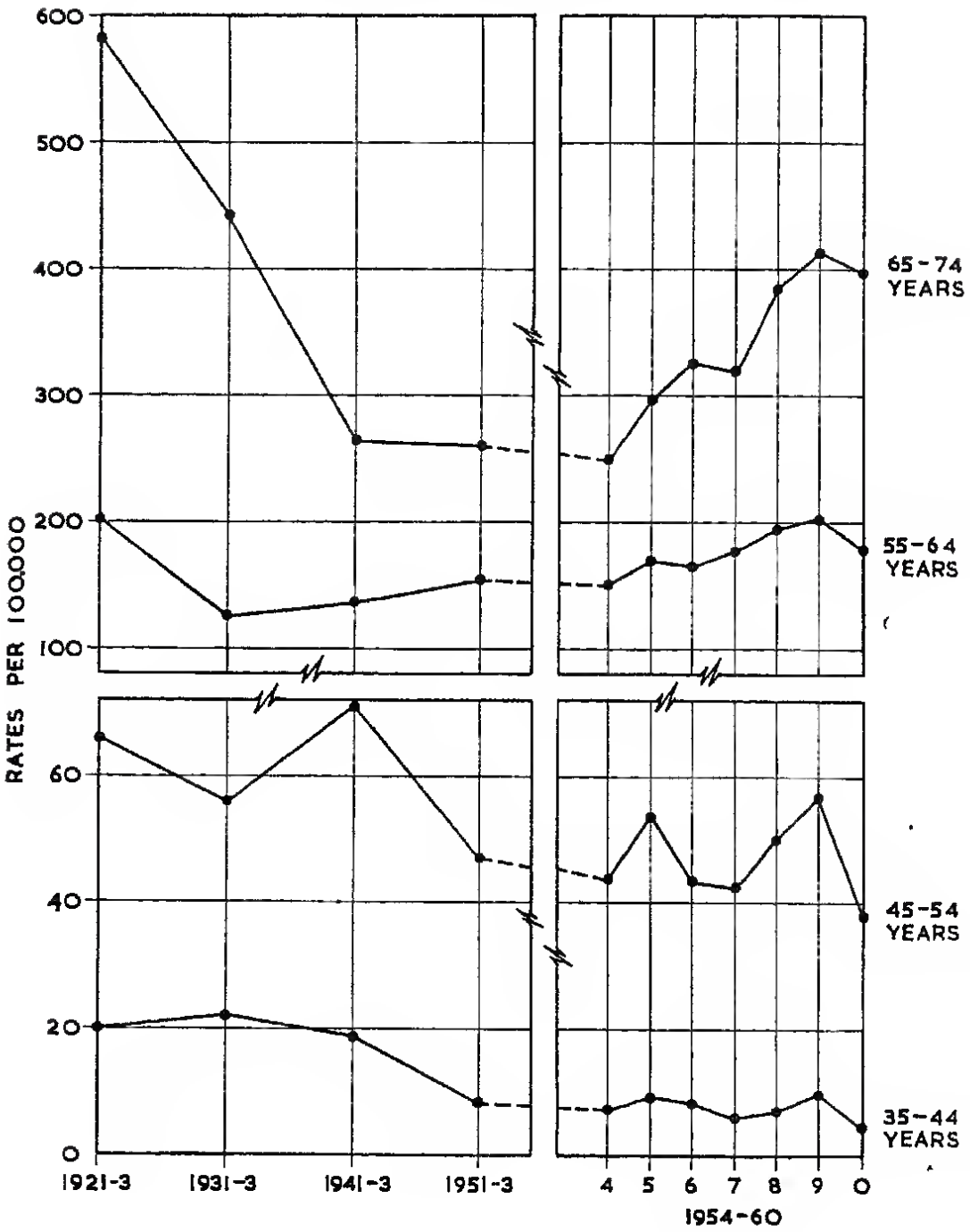

Figure 2.

Bronchitis Death Rates for Females aged 35-74 years. Scotland 1921-1960.

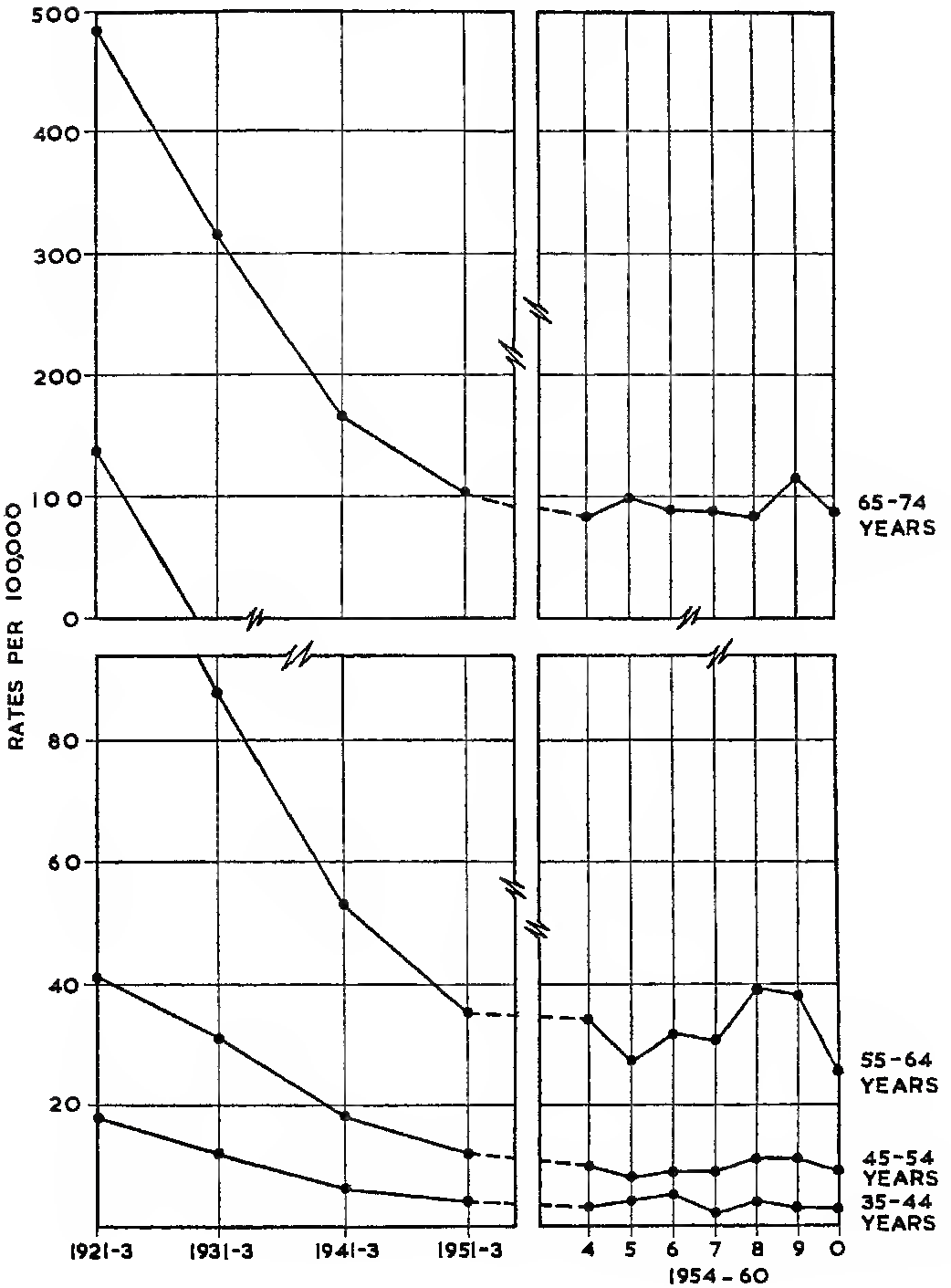

Figure 3.

Bronchitis Death Rates by Age and Sex, Scotland 1960.

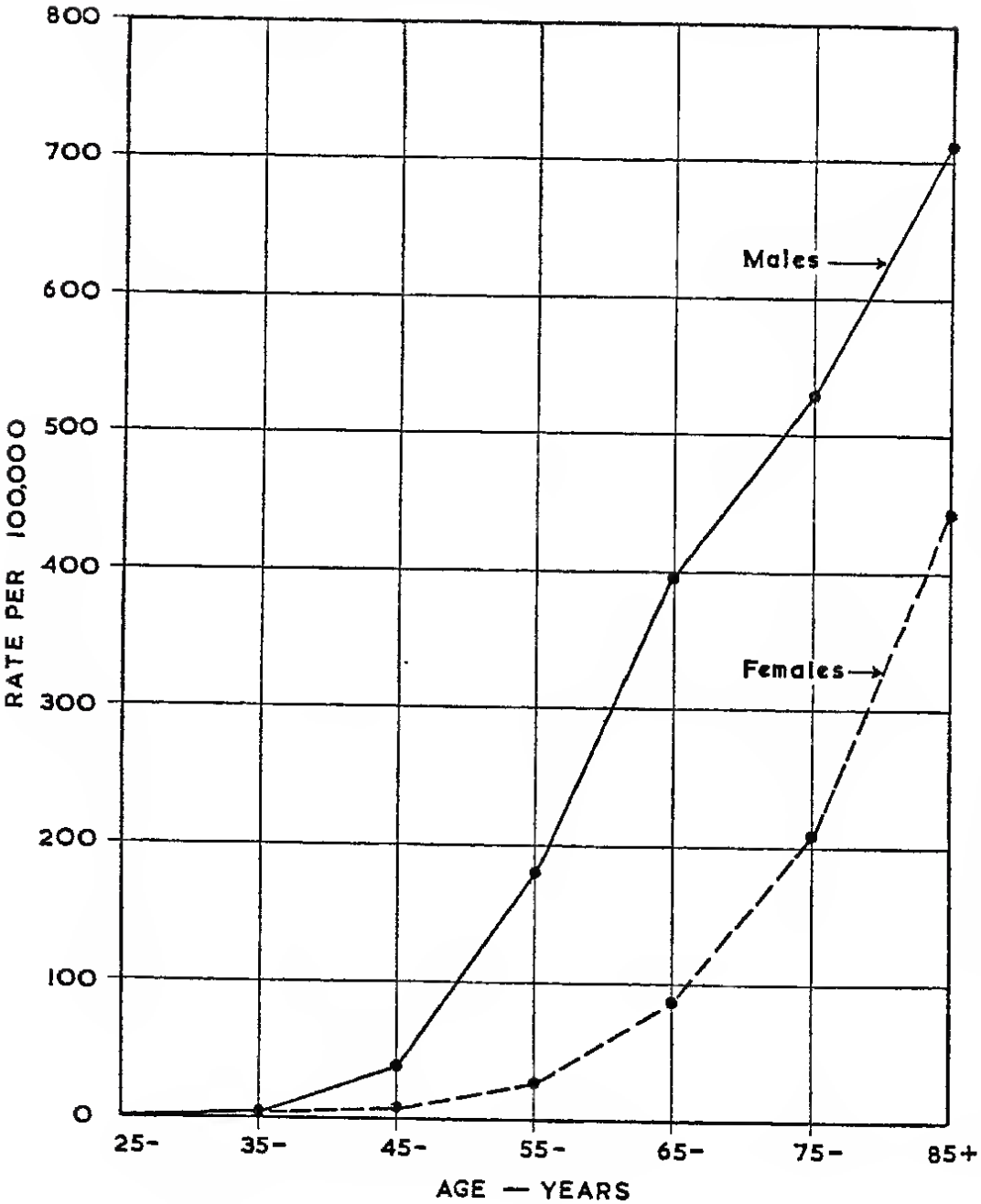

Figure 4.

Branchitis Death Rates amang Men aged 35 years and aver in selected cauntries, 1958.